Railway Mechanical Engineer

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The demand for increased output from modern locomotive repair shops has brought about many changes in organization—both from the standpoint of men and methods. There is a difference of opinion among mechanical department officers as to just what extent the repair forces and facilities at engine terminals should assist in maintaining motive power. One group advocates making all classified repairs in the main shops and, in addition, handling as great an amount of heavy running repairs as possible so that, in effect, the engine terminals are required to make only such repairs as are required to keep the locomotives in condition for road service. This has the effect of making it possible to limit the forces and facilities at certain engine terminals. In direct contrast with this, another group advocates the handling of even the heavier running repairs and in some cases light classified repairs in shops located at engine terminals so that only the heavier classified repairs are handled in the main shops.

Study the problem as a whole

It is doubtful whether it is possible to say that one plan is better than the other—the chances being that a great deal will depend upon conditions existing on individual roads. There is one factor, however, that exists in both cases that is extremely important and that is the effect of handling enginehouse work in connection with the regular run of repair work in the back shop. Many shop supervisors who have been able to work out effective shop scheduling systems have found it difficult to know how to balance the work in locomotive shop sub-departments in such a manner that emergency enginehouse work will not interfere with the effectiveness of the scheduling system. The handling of work for the enginehouse in the back shop would not in many cases have such a disastrous effect on the regular shop work were it not for the element of uncertainty. This work does not come to the shop in a steady volume nor is it of such a nature that it can be handled in a routine manner.

Locomotive shop output has ceased to be purely a departmental problem. While in most cases, up to the present time, the particular manner in which the work is handled in any particular shop is left to the ingenuity and initiative of local shop supervisors, it very often proves the case, after costly experiments in organization, that the effectiveness of the shop as a unit in the whole maintenance of equipment scheme can be enhanced by developing a shop system which fits in with the general method of handling locomotive repairs on the entire road. Such being the case, general mechanical department officers must, sooner or later, take an active personal interest in the detailed methods used to promote shop efficiency and it may be discovered in many cases that they alone have the necessary authority to make the kind of changes which will enable the back shop to function with greater effectiveness.

The possibilities of the drilling machine as a general purpose tool in the railroad shop are pointed out in an article in this issue. A machine in this service is in danger of excessive abuse which can be avoided if thought is given to its operation. A drilling machine is a carefully constructed and accurate tool and should be treated as such. Regardless of how massive a machine may be constructed or of the driving power conveyed to the spindle or feed mechanisms, the machine may be unduly strained and abused. Drill spindles should at no time project further from their housings than is actually required for the work. This point seems to be generally disregarded not only in railway shops, but in all shops where drill presses are used. Non-observance of this rule frequently results in sprung or bent drill spindles.

Abuse of the drilling machine

The new machine must be lubricated frequently and should be given light service until all bearings are thoroughly worn in. Good judgment in the earlier stages of usage of a drill press will prolong the service life. Collets or tool shanks must fit the drill spindle accurately. No other condition should be permitted. Heavy work should not project beyond the table without suitable outward support. Otherwise, deflection or spring of the machine will result. The drill table is intended as a support for the work, not as a bench block. Rough usage will cause the table to be bowed or arched. Accurate work cannot be produced on it in this condition.

Possibly no more severe strains can be imposed on a drilling machine than that occasioned by forcing a dull drill into the work or by the continuation of the feed pressure after the drill has ceased to revolve. A skilled operator will know by the "feel" of the drill when fed into the work by hand whether the tool is or is not cutting properly. This is particularly true of large drills. Insufficient clearance will set up excessive stresses in the column of the machine. For this reason it is good practice to feed a drill into the work by hand until it is cutting to the full diameter of the hole. Lack of clearance will readily be detected if the operator follows out this practice.

The twist drill is the object of more abuse than any other tool. It has been found that most of the complaints relative to the improper working of drills, can be traced to imperfections in the machines rather than in the drills. These imperfections are in the nature of lack of rigidity, usually on account of the machine being used beyond its capacity, or the machine is not sensitive enough to care properly for the lighter work of small drills. In the first case, spindle vibrations are set up, causing chatter at the point of the drill. This is apt to cause a chipping off of the cutting edges of the drill which quickly leads to failure. In the second case, it is found that the work is apt to be done on machines which are too heavy and

which lack the proper speeds and balance for the successful operation of the drill.

The upkeep or repair of the machine is of vital importance to the success or failure of the drill. Attention to the spindle bearings, particularly the thrust, is essential. If the thrust bearings are worn there results a back-lash. This is a dangerous feature since there is considerable point pressure on a drill on its way into the work and when the drill is breaking through there is apt to be a sudden release from the thrust, causing the drill to shoot ahead of the natural feed. When this happens, the drill bites into the remaining undrilled portion, causing an undue stress on the drill with resultant breakage.

It is often noted that the taper holes in the spindle ends and in the sleeves, sockets or adapters are worn until the taper is not true, and the drill shank which, when it is new is of accurate taper and correct dimensions, does not closely fit its mating member. Ofttimes dirt and fine chips accumulate in the holes, causing a poor fit. A little attention to these details will save many disagreeable drill troubles. About 90 per cent of drill trouble and breakage is due to loose spindle condition and worn out and dirty taper holes.

Advances in leadership training

A survey which has recently been made by the *Railway Mechanical Engineer* of the developments in foremanship or leadership training in the mechanical department, will be found in another part of this issue and speaks for itself. The progress which has been made in this respect during the past year is little less than marvelous. Two or three outstanding factors are worthy of special notice. It is surprising, for instance, to find that there are so many agencies at work on this problem of training for leadership and that so many of them are available to the railroads if they feel the need of them.

Whether the foremen gather together in a club to listen to addresses and talk them over, whether they meet in staff meetings as many of them always have, or whether they take up the study of leadership in groups or classes, it is advisable that the discussions be conducted in a way which will bring out the very best thought in the group and get all of the members to contribute to it. This is something of an art which has been very little understood until recent years. It is significant that there are now intensive training courses, whose sole object is to train foremen or supervisors to lead such group discussions or conferences. Present indications are that a number of the mechanical department foremen and supervisors will take advantage of such courses during the coming summer.

Another noteworthy development is the increasing number of foremen's clubs. These differ greatly in their types of program and organization, depending upon the local conditions and personalities. Some of them are securing excellent results in developing fellowship and acquaintanceship among foremen and supervisors who have known little of each other in the past except through correspondence, and this has done much to bring about friendly co-operation and to overcome misunderstandings and eliminate needless friction. Then, too, it has been comparatively easy in some cases to trace direct results from the work of these clubs in improved operation or savings of one sort or another. A more or less intangible result which cannot be measured in dollars and cents is the effect upon the morale of the workers due to more intelligent leadership; the possibilities in this direction are claimed by some to be almost limitless.

These are only a few of the important developments that were discovered by the survey, a careful reading and study of which is recommended to all those who are interested in this most vital question of leadership and more efficient management.

A machine tool program

One of the important railroad shops in the south contains an old belt-driven drill press with the date 1869 embossed on the frame. The arrangements for drive and feed are of weird design, as might be expected from the age of the machine, which, however, is in daily use. It is difficult to understand on just what grounds an otherwise progressive road justifies the use of this machine even for the light drilling operations on which it is employed. Lest undue prejudice be charged, it may be stated that a few machine tools, almost if not equally as ancient as the 1869 drill press, are in operation in northern railroad shops. There can be no question, however, that on the whole the general standard of railroad machine equipment has been appreciably raised in the past few years.

This is as it should be, but there is still room for marked improvement in some shops and enginehouses. The best results can never be obtained as long as many of the old machine tools and shop equipment now employed are continued in service. Not all railroad officers, particularly those in higher executive capacity whose duties involve little direct contact with machine equipment, realize the tremendous development, improvement and evolution which have taken place in shop machinery in the past few years. For example, a nationally known manufacturer of machine tools does not build a single machine in 1926 which resembles that type of machine made in 1920 except in a very general way. And the changes are not confined to "body lines" as is sometimes done to stimulate sales with yearly models of automobiles. Increased power, reduction of hand operations and studied layout of the whole design to permit maximum machine output with minimum operator effort are embodied in the new machines.

The modern standard and special machines now available for use in railroad shops and enginehouses are a splendid tribute to the toolmaker's art. At least one railroad has studied its machine tool situation with a view to replacing antiquated types, dividing the new machines needed into three groups: Those which will pay for themselves in six months; those in one year, and those in two years. Is this not a logical basis upon which to approach the problem and will not such a study make a forceful appeal to the executive who must approve of the expenditures?

Apprentice gatherings

Several significant developments have taken place in recent months in the group activities of apprentices on different railroads. An article elsewhere in this issue tells of the third annual apprentice conference on the Santa Fe. During the early part of May all of the apprentices on the Missouri-Kansas-Texas gathered for two days at Parsons, Kan. The visiting apprentices had an opportunity of going through the shops on the first day and a banquet was given in the evening, which was attended by several of the general officers, as well as by the local supervisory officers and foremen. The young men had a rousing time and in addition to several short talks, listened to an address on the economic importance of the railroads, the work of the mechanical department and the part which it plays in railroad operation, suggestions as to the boy studying to fit himself for the future, together with some

words of inspiration and encouragement. On the following day—Saturday—a baseball match was played between two of the apprentice teams which had made the best records up to that time.

A few days later all of the apprentices at Topeka on the Santa Fe had the pleasure directly after the shop closed of a personal message from the assistant to the vice-president who is in charge of the mechanical department, and also of hearing an address much along the lines of the one above mentioned at Parsons. During the latter part of May all of the apprentices at the West Springfield shops of the Boston & Albany held a rally and were addressed during working hours along lines which were helpful and encouraging.

These things, added to the splendid work which is being done among limited groups of apprentices by apprentice clubs, the American Railway Employed Boys Clubs, or similar organization, are doing much to encourage the young men and develop that intelligent booster spirit which is so necessary in building a spirit of teamwork and co-operation among the younger group. Young men who have such opportunities are bound to take their jobs more seriously and to relieve the supervisory staff of a good bit of trouble that may be caused by those who are careless and indifferent about their tasks and do not have a proper appreciation of the dignity and importance of their work.

Does apprentice training pay?

An interesting situation as to apprentice training exists in the mechanical departments of railways in the United States. Slowly but steadily the number of roads that are putting in modern, up-to-date apprentice systems is increasing, being patterned more or less after the methods and practices of the Atchison, Topeka & Santa Fe. As a matter of fact, the apprentice supervisors on several of the railroads are graduate Sante Fe apprentices. At the other extreme are a number of roads which are giving little if any attention to apprenticeship; true, they have apprentices, but no one seems to be paying any great amount of attention to them.

Some mechanical department men are saying frankly that they believe that the time for the all-round mechanic on the railroad is about past, and that hereafter the greater part of the mechanics will be specialists, with little if any training except within a very limited range. They are not particularly interested in recruiting apprentices or, indeed, in having apprentices, but take on helpers or handy men and in some cases designate them as helper apprentices. The advantages of a modern apprenticeship system, which will prepare all-around mechanics, as contrasted to the other type, is clearly developed in the article on "Railway Apprentice Training" by T. C. Gray, supervisor of apprentices, Missouri-Kansas-Texas, in the May number of the *Railway Mechanical Engineer*, page 269.

Those railway mechanical department officers who have given modern apprenticeship methods a thorough trial are enthusiastic over the results. In the first place, it is possible to attract a higher type and better educated boy to the service. In the next place, if schoolroom training is co-ordinated with the work in the shop and his activities in the shop are closely supervised, the boy develops rapidly. Much less work is spoiled, the quality of the work is far higher, and the output is very considerably increased—enough so, indeed, to pay well for the cost of the better type of training and the loss of time from the shop in the schoolroom.

The moral side of apprentice training is ordinarily also stressed, as was recommended and outlined by F. E. Lyford, apprentice supervisor of the Lehigh Valley, in the April number of the *Railway Mechanical Engineer*, page 214. This has a distinct reaction upon the improvement of morale and cannot be lightly regarded for its effect in making better workers in the shop as well as better citizens for the community. The men who now head the most progressive apprenticeship departments on American railroads are very much alive to developing and strengthening the character of the apprentices under their charge.

It is becoming more and more the practice also to see that the apprentices are given information about the economics of railroading and the relationship of the railroads to the community. This is making real boosters of them. It is interesting to note how the community reacts to this intelligent booster spirit on the part of the younger men. It is doubtful if many things could be done by the railroads which would have a more pronounced effect on getting the good will of the public than by having it generally known and recognized that the managements were interested in improving the standards of and helping the younger men.

Another advantage of a thorough apprentice training is its value in attracting and developing boys and young men who have leadership talent and can be promoted to supervisory positions. Too little attention has been given to this question of training men for supervisory positions. Such training should start early and several mechanical superintendents emphasize the importance of good apprentice training as a foundation for future foremen and supervisors.

It is impossible to equate all of these advantages on a monetary basis, but those who have tried out modern apprenticeship methods insist that they pay big returns upon the investment.

Some of the larger roads have developed or are developing excellent courses of training and instruction for the apprentices; some of the smaller ones are having difficulty in this respect. The suggestion was made by C. Y. Thomas, supervisor of apprentices of the Kansas City Southern, in the *Railway Mechanical Engineer* of March, page 155, that sort of clearing house should be established by which the railroads could pool or exchange information as to tests and practices, possibly under the direction of Division V of the American Railway Association. This would ease the burden on the smaller roads of developing suitable tests and the large roads would also profit by the exchange of such information.

Shop schedules and new machine tools

The railroads of this country have been the object of some adverse criticism from time to time because of the manner in which new machine tools are purchased and because of the fact that, as compared with industrial plants, there has apparently been a lack of appreciation of high-grade machine tools. One of the surprising things which develops when an effort is made to look into the exact conditions surrounding machine tool equipment in both railway shops and industrial plants is the fact that the average modern railway shop compares very favorably in its machine tool equipment with the average industrial plant, with the possible exception of recently constructed highly specialized industrial plants, such as modern automobile shops where production machinery is a vital necessity. Production machinery, as known to the automobile plant, is not a necessity nor has it any place in the average railroad shop be-

cause the type of work is entirely different and in the majority of instances it is not necessary to work to anywhere near as close tolerances. Therefore, in the consideration of machine tool equipment for railroad shops it is a fact that, as in all other industries, certain machines are better adapted than others to a particular class of work.

The real imporant questions to be answered are: First, what kind of machine is best adapted to the job at hand; and second, how can a mechanical department officer feel reasonably certain that he is going to get the kind of machine he wants?

Machine tools, while they may be of vital importance to the men at the head of the mechanical department, are of relatively less importance to the executive officer from whom the mechanical department officer must get his appropriation to purchase them. One thing in which the executive officer is always interested, is in knowing whether or not the money which is spent for new equipment will produce savings in operation and if so, how much. It does not seem logical to suppose that it would be a difficult matter to get just the kind of machine that a mechanical department officer might want for a particular job if, in requisitioning that machine, indisputable data were given to show whether or not that machine would save money and if so, how much.

In many instances under the present system of buying machine tools, the purchasing department is allowed a great deal of leeway and naturally price is the dominant factor where, to the purchasing department, quality and productive capacity seem to be nearly equal. One development that has taken place in the railroad shops within the past few years which is of great importance in machine tool selection is the development of shop scheduling systems. Directly, shop schedules exert little influence over machine tool selection but indirectly they lead to the development of information that should give the mechanical department officer an irrefutable argument when he requests the purchase of a machine of some particular make and type. Shop schedules, intelligently developed and applied, will give a picture of the operation of a whole shop. Many schedules embody the use of reports which record the departments or operations which are consistently falling down on the job. To a progressive shop supervisor, such a record should lead to an investigation of the cause for consistent delays in any particular department. Poor shop operation, as a whole or in any unit, can be attributed to some shortcomings either in men, methods or machinery. It may be that the methods involved in any particular case are the best that can be used with the present equipment. It may also be equally true that the present machine tool equipment is producing all that it is capable of producing. It should not be a difficult matter, knowing where the weak spots are, to make time and costs studies which will show how much could be saved by changing methods and machinery, and if the proper kind of study is made on machine tool operations, there should be little difficulty in selecting the kind of machine that would best handle the particular job under consideration.

As a final suggestion, would it not be worth while trying out at the time the next request for a machine tool appropriation is submitted to eliminate entirely a list of individual machines and their estimated cost and substitute instead a statement showing the total appropriation requested together with a general report explaining what improvements are planned, what savings may be expected and what the effect on the maintenance of equipment cost will be. Provided an adequate saving can be shown, it is doubtful whether any progressive executive officer will refuse to listen to a request for appropriations, the expenditure of which can show as great a return or a larger return than the appropriations for equipment requested by other departments.

New Books

LOCOMOTIVE AND BOILER INSPECTORS HANDBOOK, *by A. J. O'Nail, locomotive inspector, Public Service and Transit Commission for the State of New York. 274 pages, illustrated, 4½ in. by 7½ in. Bound in cloth. Published by the Simmons-Boardman Publishing Co., 30 Church street, New York. Price* $2.50.

Boilermakers, machinists, enginemen and firemen may work on locomotives for years and claim that they know an engine from coupler to coupler and from the rail to the sand dome, but when they are required to take a written or oral examination, many of them fail to make a passing mark. The reason for this is that they have gained their knowledge piecemeal over a period of years and have never given serious thought to the fundamental reasons why locomotives and boilers have to be maintained to meet a certain set of required rules and regulations. Many of these men never have had the opportunity to study these rules and regulations and do not know what to expect in a competitive examination for the position of a federal or state locomotive inspector.

The first six chapters cover the laws, rules and instructions for the inspection and testing of locomotives and tenders and their appurtenances as laid down by the division of locomoitve inspection of the Interstate Commerce Commission. The first chapter contains the original locomotive inspection law passed in 1911, and all subsequent additions made to that law up till the present date. It is imperative that all locomotive inspectors thoroughly understand this law as all of the rules and regulations governing the inspection of locomotives on all the railways in the United States are based on these laws which have been approved by Congress. Rules and regulations for the Inspection of Locomotive Boilers, Rules and Interpretations for the Inspection of Steam Locomotives and Tenders, Locomotive and Safety Appliance Standards, are the headings for the following three chapters. Chapter VI contains the rules and instructions relative to the method of preparing and filing the inspection reports required by the Interstate Commerce Commission. This chapter contains reproductions of these reports which are filled out according to standard practice.

Chapter VII contains a list of questions and answers asked in examinations given to those whose ambition is to become a locomotive inspector. This list indicates the type of questions on both boiler and mechanical work which are apt to be given in an examination. The author offers to amplify, on the request of the reader, any questions which may acquire a further explanation. These questions are grouped according to the subject matter, each group headed with a sub-head such as the construction of the locomotive boiler, joints and strength of boiler, combustion and evaporation, boiler inspection and defects, etc.

Chapter VIII contains 52 pages on the rapidly increasing important subject of welding. Welding is a comparatively new process of making repairs which is used very extensively by the railroads. A competent locomotive inspector should know the fundamental principals governing both gas and electric welding and be able to inspect a welded job in order to determine whether the weld has been properly made and whether it will withstand hard service. The application of electric and gas welding to all locomotive parts now commonly welded is thoroughly discussed in this chapter.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

Apprenticeship and the Mechanical Division

West Springfield, Mass.

To the Editor:

Your splendid editorial in the March issue together with the article by Mr. Thomas of the Kansas City Southern relative to "Standard Apprentice Training," are two fine contributions on an important subject.

Mr. Thomas clearly states the difficulties in this problem which face every railroad in the country with the possible exception of the New York Central and the Santa Fe. He has suggested the logical solution, that is that the A. R. A. through Division V have a committee on this subject which can work out standards, make revisions, and thus make available to all the very much worth-while benefits of apprenticeship.

The faculties of colleges having railway engineering courses and representatives of the Federal Bureau of Vocational Education would also be of great help, if invited to co-operate in this work.

Railroad apprenticeship is of sufficient importance to justify a national grouping of apprentice instructors to meet one or two days as a sub-division of Division V to discuss their problems.

I trust this matter can be called to the attention of Division V of the A. R. A. and proper action taken at its next meeting.

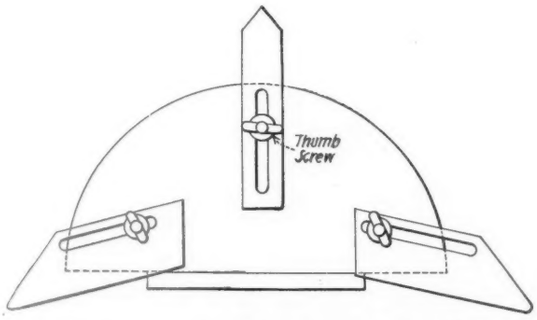
Harry C. Fletcher,
Apprentice Instructor, Boston & Albany.

Another gage for laying-off driving box brasses

Kansas City, Mo.

To the Editor:

The March issue of the *Railway Mechanical Engineer* contained a question from one of your readers who signed his name "A Constant Reader" wanting to know a good method of laying off a driving box crown brass for machining to fit in the box after it had been finished on the outside to the diameter of the box.



A simple gage for laying of driving box brasses

The gage shown in the illustration has been satisfactorily used in our shop for a number of years. It consists of three adjustable legs mounted on 1/16-in. steel plate. The two lower legs are first set to the contour of the driving box. The top leg is then set to obtain the size of the box.

The brass that is to be laid off is placed up side down on a plane surface after which the set gage is placed with the top leg on the face plate. With the gage in this position, the two edges to be planed are laid off from the two lower legs.

Frank Southwick,
Machine shop foreman, Union Pacific, Kansas City, Mo.

Cast iron wheels—A loss or a gain

Sayre, Pa.

To the Editor:

Considerable financial loss can be sustained in a year by negligence on the part of those responsible for the inspection of wheels and axles and the proper billing for them on the billing and repair cards. A good example is found in the case of a pair of 5½-in. by 10-in. cast iron wheels which were removed from a foreign car on a cripple track on account of one of the wheels having a worn flange. The remaining wheel was O.K. according to the standard A. R. A. wheel defect gage and was marked as fit for further service. The removal of the pair of wheels could be classified under the heading of owner's responsibility and credit allowed for two 5½-in. by 10-in. cast iron wheels, one as scrap at $6.30 and the other at $9.55, making a total of $15.85.

This example would apparently tend to show that all parties concerned had received the proper credit allowed in the A. R. A. rules, but after the arrival of this pair of wheels at the wheel and axle shop, which is usually located at some distance from the point of removal, the wheels are inspected by the wheel inspector with the limit gages for the unmounting of cast iron wheels, and it is found that the wheel which has previously been accepted as fit for further service takes the limit gage and is, therefore, condemned as scrap.

A billing and repair card has already been made out covering the removal of this wheel, allowing credit for $9.55, whereas the inspector at the wheel and axle shop has found it to be unfit for further service, and its real value should be $6.30. This difference of $3.25 is a loss to the railroad company whose inspector either did not know of the limit gage used in the remounting of wheels or had failed to make allowance for the difference between the two gages.

This is only one instance of where a railroad can lose money by the neglect of an inspector to carefully inspect wheels and axles.

Old Timer.

Nickel Plate foremen's club at Conneaut, Ohio

Training for leadership

Remarkable progress made during the past year in improving standards of supervision

Synopsis

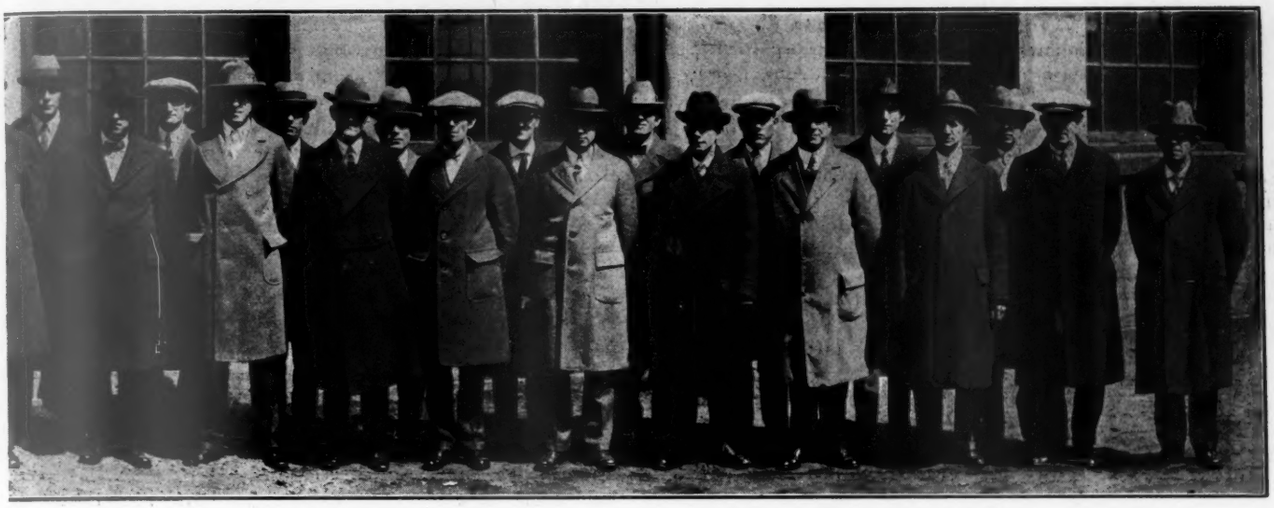
FOR many years the *Railway Mechanical Engineer* has consistently advocated the necessity of encouraging and assisting the foremen and supervisors to study the fundamental principles of foremanship and improve their leadership ability. This publication has insisted that the foremen were really the keystone in the arch of the organization, forming as they do the contact points between the workers and the managements. It is not sufficient that a foreman should be a good craftsman, but far more important is the ability to exercise wise leadership over the men under him. Without such ability friction will surely be engendered with resulting irritation and loss to all concerned. The foreman must be more or less of a diplomat in interpreting the men to the management and the management to the men.

To focus attention upon this vital problem in organization, the *Railway Mechanical Engineer,* in its program last year, attempted to do two things. First, through a prize competition for articles on the opportunities and responsibilities of the foremen, an effort was made to get the best thought from the field and to stimulate discussion of this important question. The results far exceeded our expectations. "Top Sergeant" challenged "Bill Brown" and precipitated a discussion which probably stirred up more interest throughout the mechanical department than any other one question which has ever confronted its foremen and supervisors. Second, a more or less careful survey was prepared for publication in the June, 1925, issue on exactly what was being done to assist the foremen and supervisors in improving their leadership ability. This, too, proved to be stimulating and productive.

Thus far this year the *Railway Mechanical Engineer* has been following up these questions persistently from month to month. The present article is a survey similar to the one made a year ago, but more comprehensive because special steps have been taken to broaden the inquiry and check, to a larger degree than was possible last year, what was being accomplished.

In general, there has been a distinct advance all along the line. The increase in the number of foremen's clubs is particularly noteworthy, while some roads are introducing unusual training measures which promise to give large results. It is significant that both on the railroads and in the industries more attention is being given to the conference method, and a movement which was only started in a small way a year or two ago of intensive preparation of conference leaders, is rapidly gaining strength and popularity.

That industry in general feels the same need for foremanship or leadership training is indicated by the fact that the Department of Manufacture of the Chamber of Commerce of the United States, Washington, D. C., last October issued an excellent report or survey on the "fundamentals in the development of industrial foremen." The Policyholders' Service Bureau of the Metropolitan Life Insurance Company also prepared a similar study, entitled, "Training Key Men in Industry." While neither of these was devised specially for the railway mechanical field, they apply equally as well to it as to other industries, since they are primarily concerned with the principles of



leadership rather than with the methods and practices of the crafts.

So important is this question of foreman training in the eyes of the Chamber of Commerce of the United States that it was one of the major questions discussed at an industrial group meeting, held in connection with the fourteenth annual meeting of the Chamber at Washington in May. The following statement is quoted from the announcement issued by the Chamber of Commerce:

"Restricted immigration, elimination of waste and lost motion, the need for restoring as far as possible the old-time relations between the employer and employee which obtained in the days of the small shop, are some of the reasons why industry is giving special attention to the selection and training of men occupying the important supervisory positions at the lower end of the industrial ladder.

"It has been recognized for some time that the study of human relations is one of the most important factors in successful managing, for notwithstanding the fact that a plant may be equipped to the last word with mechanical contrivances, it is, after all, the attitude of the workman's mind, each day as he enters the plant, toward his employer and his job, which determines whether or not he will get out large or small volume. Moreover, today, because it is an impossibility for the general officers of a concern to come in daily contact with those who are looking after the details of production, some efficient substitute must be supplied; that is, someone who will be able to impart to the workman not only the orders but the vision of management and, on the other hand, transmit to management the feelings and reactions of even the most humble employee, for it takes co-operation clear up and down the line to get results.

"The larger concerns as usual seem to have appreciated first the need for trained foreman, and the training schools and classes existing at present are to a great extent in the larger plants of the country, but not exclusively so, for in many of the smaller places manufacturers have combined or organized and are maintaining and supporting joint classes. The teaching forces are developed in various ways, sometimes in the plant where the training class is maintained; again, by engaging specialists; still again, through the Federal Board of Vocational Training, Young Men's Christian Associations, colleges and universities.

"The Federal government, in co-operation with the states last year, spent $6,198,716.08 on various types of vocational training, a very considerable part of which was devoted to the training of foremen. Recently, the National Association of Foremen was organized at Dayton, Ohio, and several states have state groups of these training classes."

In presenting the following results of our survey, appreciative acknowledgment is made of assistance rendered by mechanical department officers, the extension departments of the state universities, the state departments of education and of vocational training, and Railroad Y. M. C. A. secretaries, as well as representatives of the Industrial Department of the Y. M. C. A.

Staff meetings

It is quite common practice for the supervisors and foremen at the larger shops and engine terminals to hold staff meetings at regular intervals for the discussion of matters of all sorts relating to the shop program or schedule, as well as to organization, facilities and shop practices. This seems to be the most natural way of approaching this entire question of the education and training of the foremen and supervisors. Such staff meetings function as clearing houses and broaden the vision and interests of the department foremen, encourage teamwork and intelligent co-operation and make for closer contacts between the foremen and the officers. In many cases such meetings are on company time and attendance is compulsory.

In some instances the foremen are called together for a few minutes each day to review the situation, check up on any weak spots in the organization or program and plan for the following day's work. Such meetings are usually held on company time or directly after the shop closes. Obviously, there is little if any time for the discussion of the principles of leadership, unless some emergency arises to focus attention upon it. On some roads the daily schedule meetings, as they are sometimes called, are supplemented by regular weekly foremen's meetings, at which time subjects of general interest are discussed and the foremen make recommendations as to methods of performing the work assigned to them. On the Michigan Central, at the St. Thomas shops, for instance, the assistant supervisor of shops attends these weekly meetings in order that there may be an opportunity for comparing the work and practices at St. Thomas with those at other points. The discussion is thus stimulated and a certain amount of friendly rivalry is created, which has an obvious value. Another example is the Missouri Pacific which holds short daily meetings after shop hours; these last from 10 to 30 minutes. It is the practice to discuss briefly the day's operations and outline the program for the following day. Regular weekly meetings are also held at all shops and roundhouse points and in the car department. These are more formal and elaborate.

A goodly number of roads hold similar foremen's or staff meetings at the more important points, either at regular intervals, weekly, semi-monthly or monthly, or as oc-

casion may seem to require. On the Atlanta, Birmingham & Atlantic, for instance, the object of these meetings is "to stimulate interest and educate the foremen better to supervise their forces and handle the work economically and efficiently.

In general, it may be said that while the practice at such meetings is to discuss shop practices and facilities in more or less detail, there seems to be a growing recognition of the importance of exchanging experiences on how best to deal with the human element, although, except in a limited number of cases, it is not evident that special stress is being placed upon this most important question.

On the Chicago, Milwaukee & St. Paul the purpose of such meetings is to discuss "matters pertaining to the local output" and "comparison in output with other points on the system. At these meetings the foremen discuss problems of human relations and methods that will be of mutual advantage to employer and employee."

Weekly Staff Meetings

A large number of the roads hold weekly staff meetings. At some points where such meetings relate mostly to questions concerning the shop schedule, monthly meetings of a more general and extensive nature are also held. This is true of the Union Pacific, the monthly meeting of the latter road being termed a "mechanical efficiency committee meeting."

Semi-monthly Staff Meetings

Semi-monthly meetings are held on the Virginian, at which time shop practices and irregularities are discussed.

The semi-monthly meetings on the Missouri-Kansas-Texas are presided over by the shop superintendent and are held immediately after the shop closes. These are conducted according to parliamentary procedure. Minutes are kept and a regular order of business is closely adhered to. The local storekeeper attends the early part of the meeting, which is devoted entirely to matters pertaining to shop output and material needs. The latter part of the meeting is given over to the reading and discussion of a paper prepared by one of the foremen and dealing with the principles of leadership. The personnel department co-operates by assisting in the development of these papers. While the open discussion is quite generally participated in by those present, the presiding officers do not hesitate to call upon individuals for expressions of opinion—this in order to broaden the discussion and make it as inclusive as possible. The minutes of the various meetings are forwarded to the mechanical superintendent for review.

Monthly Staff Meetings

Monthly staff meetings are held by a number of roads. Attendance at the Minneapolis & St. Louis meetings is compulsory. The monthly staff meetings of the Illinois Traction System discuss car and locomotive failures; safety, reliability, loyalty and co-operation are always stressed at such meetings.

In some cases, as on the Soo Line and the Reading, the mechanical department general staff meetings usually include some of the foremen.

Monthly meetings of the boilermaker foremen are also held on the Reading.

Annual Staff Meetings

Annual staff meetings of a rather unusual type are held by the following groups on the Chicago, Milwaukee & St. Paul: special apprentices; chief clerks; air brake foremen; car department foremen; boiler foremen; traveling engineers; roundhouse, toolroom and general foremen; and master mechanics. The programs for these meetings are planned far in advance of the time of the meeting, much as with any of the national railway associations, and carefully prepared papers and reports are thoroughly discussed. A more or less keen rivalry has grown up between these different groups as to which one can put over the most effective meeting and secure the best discussions. An unusual feature at the annual staff meetings of both the car and locomotive departments is the presentation of prizes for the best operated and maintained local premises.

Foremen's clubs

Much progress has been made during the past year in the formation of foremen's clubs at many points on a number of different railroads, and in the strengthening of the programs of clubs which had already been formed. In general, such clubs are organized on the initiative of the foremen; they meet once a month for seven or more months of the year; the meetings are largely technical, but there is also some opportunity for social features, either at the regular meetings or at the closing session of the season. In some cases, where conditions permit, the meetings are preceded by a supper. The following notes concerning the methods used on some of the railroads may be of interest.

Atchison, Topeka & Santa Fe

The foremen at Argentine, Kans., organized a foremen's club something more than a year ago. It meets on the first Monday of each month at the Railroad Y. M. C. A. building and its object is to create a spirit of co-operation and good fellowship and higher standards of efficiency.

Atlantic Coast Line

Informal meetings of the foremen and supervisors have been held at Florence, S. C., during the past two years. While a club has not been formally organized and the meetings are more or less social in nature, some considerable attention has been given to the discussion of matters relating to co-operation and leadership.

Boston & Albany

A supervisors' club was formed at West Springfield last October, including in its membership officers and foremen. The average attendance for the season has been about 60. The meetings are preceded by a dinner and are held in the Railroad Y. M. C. A. building. Addresses have been made by H. S. Walton, supervisor of air brakes; W. Reichard, consulting engineer of the General Railway Signal Company; F. S. Austin, general storekeeper; J. G. Walber, vice-president in charge of personnel, New York Central Lines; Samuel Bennett, claim agent; and Roy V. Wright, editor, *Railway Mechanical Engineer*. Considerable attention has been given to questions relating to leadership. Of the 61 supervisors eligible for membership, all but three have joined the club.

Boston & Maine

Last year there were eight foremen's educational associations on the Boston & Maine. A new club was recently formed at Worcester as the result of a petition which was signed by every one of the mechanical department supervisors at that place. The various associations or clubs on the Boston & Maine have a system association, which held its second annual banquet and entertainment in Boston on Saturday, May 22. These clubs, or at least those which were first organized, have now been functioning for three years to excellent advantage. They hold, on the average, about seven meetings a year, and while most of the meetings are given over to the consideration

of technical questions, a considerable amount of attention is given to leadership and the relation of the mechanical to other departments in the interests of interdepartmental co-operation. So successful have these educational associations or clubs proved that the stores department at Billerica has recently started a club of its own and it is quite possible that similar associations or clubs will be organized in other departments. The value of such educational associations from the standpoint of a foreman is clearly indicated in the following extract of the remarks made at a recent meeting of the Fitchburg Foremen's Educational Association by the secretary, Philip Cabana:

"Why are we here and why do we hold these meetings? We believe that a better mutual understanding can be attained by bringing men together so that they may compare their experiences. Knowledge is made up not of what one man has found out, but of the accumulated experience of many men.

"Such gatherings as we have this evening are profitable because you and I have a chance to learn what the other fellow thinks. However, to make these meetings worthwhile every man must store something away and apply the knowledge gained to the interest of the Boston & Maine, and at the same time to his own behalf.

"Another purpose of these meetings is to secure a better and smoother organization, happier and more contented employees and officers, the elimination of needless waste, to become more efficient in safety practices and appliances, and to give better service to the public.

"These are the viewpoints which we must carry to our work, so as to be successful. Surely no man is so busy that he cannot afford a little time in learning more about his own work for the benefit of himself and the company he works for. A few minutes in the evenings or a few hours spent, such as we are having the pleasure of spending tonight, will do much for all of us in increasing our knowledge of railroading."

CENTRAL RAILROAD OF NEW JERSEY

Foremen's clubs were organized at Elizabethport, N. J., and Ashley, Pa., a little over a year ago and are reported to be in flourishing condition. These meet once a month, except for June, July and August. Papers are read by the members but speakers from the outside are occasionally called in. Entertainment and social features are also included in the programs. The foremen at the Elizabethport shops are also following a university extension course in leadership, as is noted elsewhere in this article.

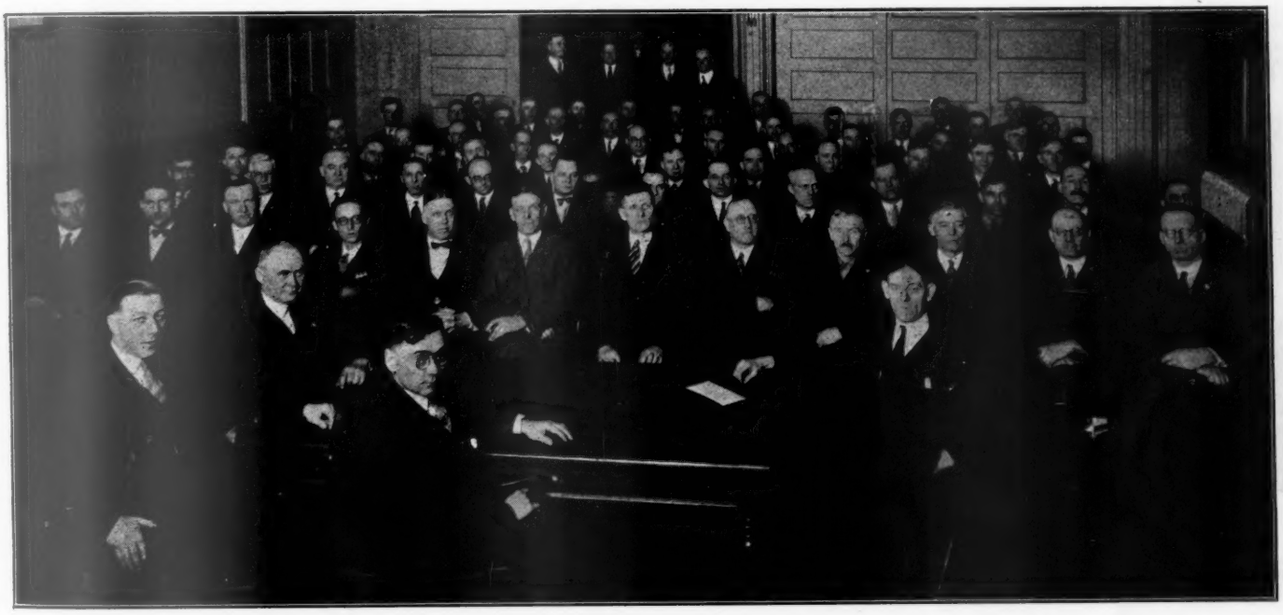
CHICAGO GREAT WESTERN

A Foremen's Booster Club meets once a week for a "cost meeting," at which time the various operations are discussed from the cost standpoint. Once a month the club holds a dinner meeting at a hotel. Usually some musical and entertainment features are provided and at least three hours are spent in the discussion of matters affecting shop output and efficiency.

During the year a list of 20 items was prepared, suggesting what the foremen could do to cut down costs, improve quality and maintain production. Each foreman was asked to present in writing his ideas or constructive suggestions concerning these items.

CHICAGO, INDIANAPOLIS & LOUISVILLE

A supervisors' organization includes all the men in a supervisory capacity below the rank of master mechanic in both the locomotive and car departments. Ways and means are discussed of increasing production as well as problems relating to employee relations. The program of the regular meetings ordinarily includes certain social features. The foremen hold an annual meeting, which is purely social and to which all of the mechanical department officers are invited.



A monthly meeting of the Scranton Council of the Lackawanna Supervisors, President Hugh Surplus, presiding

DELAWARE & HUDSON

Some of the foremen and supervisors are in a club made up of representatives of the various local industries. Meetings are held in the Y. M. C. A. or at one of the plants. The program ordinarily includes a supper, music, an address, and a well directed discussion.

DELAWARE, LACKAWANNA & WESTERN

In addition to the weekly meetings of the department and shop foremen, at which questions relating to production and immediate shop or department problems are discussed, there are three Lackawanna Supervisors' Clubs, known as the Morris & Essex, Scranton and Buffalo Councils. Participation in these clubs is purely voluntary

on the part of the supervisors, and they entirely finance the expenses. The meetings are given over to a consideration of questions relating to the fundamentals of successful foremanship, interdepartmental relationships, and various matters relating to the railroads, economic and otherwise. In addition to these purely Lackawanna clubs, the supervisors and foremen are encouraged to affiliate with city industrial clubs where such have been organized. An example is the Scranton Industrial Club, which meets at the Central Y. M. C. A. for the discussion of leadership problems. There is an obvious advantage in getting an interchange of ideas on the part of representatives of all of the industries as to the best methods of leading the workers and improving relations with the employees. The president of the industrial club at Binghamton, N. Y., which was organized by the Central Y. M. C. A. a year and a half ago, is the master mechanic of the Lackawanna, at that point, M. A. Quinn.

An important factor in the success of the Lackawanna Supervisors' Clubs is a monthly publication known as "The Lackawanna Supervisor," published in the interest of the mechanical department employees. It is 7½ in. by 10½ in. in size and ordinarily contains 24 pages, including an attractive cover.

Duluth & Iron Range

There is a supervisor's club at Two Harbors, Minn. The program ordinarily includes one or two technical papers by members. These are thoroughly discussed and special efforts are made to promote good fellowship.

Minneapolis & St. Louis

The foremen at the principal shops at Marshallton, Iowa, have a club which meets once a month. Papers are prepared and read by the members. The club has been in existence for two years.

Missouri-Kansas-Texas

There are foremen's clubs at the more important points, which meet once a month; during the summer picnics and outings are held. The programs include debates, addresses by representative men and discussions of various sorts. The club at Parsons, Kans., recently held a debate on railway electrification vs. steam operation.

New York, Chicago & St. Louis

Foremen's clubs were organized about a year ago at each of the main shops. A meeting is held each month after working hours and papers are prepared or read by the members. Special attention is given to developing the discussions. Experts from railway supply companies are also invited to address the clubs. The foremen in both locomotive and car shops are required to attend the meetings, the program being in charge of a committee of three, appointed by the shop superintendent. No difficulty is found in getting the foremen to prepare papers, since the author of a paper is given permission to visit the other shops at the next foremen's club meetings. This gives them an opportunity to look into the shop practices at the different points and also to take part in the discussions at the other club meetings. During the past season the following topics have been discussed: Training of foremen; training of apprentices; locomotive forgings; hot boxes; engine bolts, car bolts and staybolts; maintenance of air brakes; systematic method of good housekeeping and surroundings; accounting; locomotive and car inspection; inspection trips to other shops; pipes and pipe fittings for locomotives and cars.

Northern Pacific

The supervisory officers hold periodical social functions in the interests of creating a friendly and co-operative spirit.

Pennsylvania Railroad System

A complete report of the foremen's clubs on this system was given in the *Railway Mechanical Engineer* of June, 1925, page 365. The nine clubs mentioned in that article have just passed through a successful season. Each club has a president, a vice-president, a secretary, a treasurer and an executive committee. The clubs decide jointly upon the general program to be followed and as to a uniform program of subjects and speakers. The local club arranges for the meeting places, entertainment and the fixing and collecting of dues from its members, etc. Only employees occupying supervisory positions are eligible; this includes track foremen, gang foremen in the shops, and chief clerks, as well as the higher officials in all departments. The courses are now limited to eight biweekly meetings. Some of these clubs meet in the Railroad Y. M. C. A. buildings, while others meet in the local high schools. At some places, such as Sunbury, Pa., for instance, certain of the meetings are preceded by dinners.

A typical program for the past season is that of the club at Harrisburg. The topics and speakers were as follows: Army discipline, by J. W. Study, chief clerk to general manager, Eastern region; discipline in the abstract, by W. H. Ridgway, president, Craig Ridgway & Son Company, Coatesville, Pa.; railroad discipline, by C. I. Leiper, assistant general manager, Eastern Region; the high cost of poor work, by S. M. Vauclain, president, Baldwin Locomotive Works; highway motor transportation and the railroads, by F. J. Scarr, supervisor motor service; the psychology of handling men, by A. B. Van Ormer, professor, department of philosophy, Juniata Col-

The general foremen on the Chicago, Milwaukee & St. Paul meet together annually

lege, Huntingdon, Pa.; railway fuel, its cost and its use, by William Elmer, special engineer.

READING COMPANY

There are three foremen's clubs on this system—at Philadelphia, Pa., Reading, Pa., and Shamokin, Pa. Monthly meetings are held, which combine both educational and social features.

SOUTHERN PACIFIC LINES

A foreman's club was organized at the Houston, Texas, shops about a year ago, the membership including both locomotive and car department foremen and supervisors. Monthly meetings are held, which include short addresses and some form of entertainment. One of the objects of the club is to familiarize its members with railroad subjects so that they can discuss them intelligently in public. Recently the foremen at the Houston shops, with some from San Antonio, attended a course of lectures on human engineering by Dr. A. F. Sheldon. A similar course at New Orleans was also attended by the foremen at the Algiers, La., shops.

UNION PACIFIC

This system has a Mechanical Supervisors' Association, which considers all matters pertaining to the supervisory staff. This is in addition to the staff meetings and to the Council meetings which are held each month and at which the supervisory staff and representatives of the employees discuss matters concerning efficiency and economy.

WABASH

There are two foremen's clubs on this road, one at Decatur, Ill., and the other at Moberly, Mo. These meet monthly and have been in existence about two years. Foremen, gang leaders and lead men in the mechanical department are eligible. Papers are prepared by the members and reports are also made by those who have had opportunity to visit other shop points. Better acquaintanceship is fostered by occasional dances or social features.

Leadership classes

In a number of cases leadership or foremanship classes have been inaugurated at different places on some of the railroads, with the help of the Y. M. C. A., the extension department of a state university, or a state department of education or vocational training. Several things are necessary to make such classes a real success. They must be conducted under strong and efficient local direction and must have properly equipped leaders. A few years ago one railroad arranged with a state department of education to conduct a class for foremen. It started off with considerable enthusiasm, but did not last long. The instructor did not understand practical work, having had no experience in it. For this reason his problems were not at all practical and the classroom atmosphere was entirely too theoretical. Fortunately most of the university extension departments or state education departments have recognized the necessity for putting the right kind of man in charge of such classes, so that the percentage of failures is now comparatively small.

BOSTON & MAINE

In addition to the foremen's educational associations, which are mentioned elsewhere under the heading of "Foremen's Clubs," an experiment has been tried out this year among the foremen at Concord, N. H. The University of New Hampshire, co-operating with the Railroad Young Men's Christian Association, has conducted a class which thus far has given its attention largely to technical subjects, starting with mathematics, and including elementary physics, mechanics of materials, mechanics of elementary machines and blue print reading.

CENTRAL RAILROAD OF NEW JERSEY

Rutgers University, New Brunswick, N. J., has recently established an Industrial Extension Department under the direction of Prof. N. C. Miller, who was formerly associated in a similar capacity with State College, of Pennsylvania. Professor Miller recently started a course on foremanship at the Elizabethport shops. The class meets once a week.

Meeting of Foremen's Booster Club, Chicago Great Western, Oelwein, Iowa

GRAND TRUNK RAILWAY

The supervisors at the Battle Creek, Mich., shops of this railway a year ago joined with representatives of industry in that locality in a foreman training class under the direction of the Vocational Education Department of the University of Michigan. Excellent results were obtained.

RAILROADS IN IOWA

The Engineering Extension Department of Iowa State College at Ames, Iowa, has been quite successful in fostering a number of classes in foremanship at various points on some of the railroads which operate in the state of Iowa. In general this course includes 15 meetings a year, the complete course being covered in a period of about three years. Such classes were conducted on the Chicago, Burlington & Quincy at Burlington during the past two years; on the Chicago, Rock Island & Pacific at Cedar Rapids during the past three years, and at Valley Junction in 1924 and 1925; on the Chicago & North

Western at Clinton during the past three years; at Boone in 1922, 1923, 1924 and 1925, and at Missouri Valley in 1922; on the Minneapolis & St. Louis at Marshalltown in 1921, 1922, 1924 and 1926; on the Chicago Great Western at Oelwein in 1924; and on the Chicago, Milwaukee & St. Paul at Dubuque, in 1926.

Lehigh Valley

Mention was made in our survey a year ago of the two foremen's classes at Sayre, Pa.; one in the Sayre system shops and the other under the direction of the master mechanic of the Seneca division shops and enginehouse. Both of these classes were following the foremanship training course prepared by State College of Pennsylvania. This course was carefully drawn up on the basis of numerous conferences with industries throughout the state of Pennsylvania and has been thoroughly tried out. A representative of the university ordinarily assists in getting such a course started and may occasionally come to and address the class after it is organized. On the Lehigh Valley the supervisor of apprentices has charge of the class in the system shops and the master mechanic directs the work among the division foremen and supervisors. One of the local officers or a member of the class ordinarily opens the discussion.

An advanced course is also being given this year at Sayre on economics for public utility workers. This is a new course and covers in general the following topics: The development of industry, how a public utility differs from an unregulated business, ownership and control of a public utility, organization of a public utility, capital, where capital comes from, how the revenues are spent, wealth, money, wages, materials and their value, law of supply and demand, competition and monopoly, the business cycle, summary and conclusions.

Michigan Central Railroad

Many of the supervisors at the Jackson, Mich., shops are members of a foremen's class which is conducted under the direction of the Y. M. C. A., and includes representatives from the various industries.

Southern Pacific

The State Supervisor of Trade and Industrial Instruction of California, in co-operation with the officers of the Southern Pacific, conducted a foreman training conference at the Sacramento shops, beginning April 6.

State educational department facilities

A number of states, through their departments of vocational education, have rendered service along the line of foreman training, the Federal Board for Vocational Education, under the direction of Frank Cushman, chief of the Industrial Educational Service, co-operating in many instances. The following states, in addition to those mentioned elsewhere in this survey, are interested in this development and are prepared to assist the railways.

The state supervisor of trade and industrial education of the Department of Education of Arkansas, is prepared to assist roads in foremanship training.

The state director of vocational education of Connecticut is prepared to co-operate with the railroads in foremanship training.

The state supervisor of industrial education of Maryland, who is also professor of industrial education at the University of Maryland, has conducted foremanship training classes for the industries and stands ready to help the railroads.

The Department of Education of Massachusetts is prepared to conduct foreman training classes covering eight periods or lessons, preferably given one a week and each lasting one and a half hours. This service has been available since January 1, 1926.

The Department of Education of Mississippi, under the direction of the supervisor of trade and industrial education, is prepared to co-operate with the railways in foremanship training.

The Department of Vocational Education of the State of Montana in 1925 conducted a foremanship conference with foremen from the Chicago, Milwaukee & St. Paul shops at Deer Lodge, and more recently has held a similar conference with foremen of the Northern Pacific shops at Livingston.

The Ohio Trade and Industrial Education Service, under the Division State Board for Vocational Education, has conducted foreman training work in the industries and is prepared to co-operate with the railroads.

The Department of Vocational Education of the State of Oklahoma in 1925 conducted conferences for the railroad foremen on the St. Louis-San Francisco. The plan was to meet with the foremen on company time, usually from 10 to 12 in the morning, or from 1 to 3 in the afternoon. The conferences covered a period of three weeks and followed the discussion method. This year similar conferences were conducted with the foremen of the Chicago, Rock Island & Pacific at Chickasha and Shawnee.

The Bureau of Vocational Education of the Department of Public Instruction of Pennsylvania will be glad to co-operate with railroad companies in that state in the development of foreman training and apprentice training. In both instances there are state and federal funds available for such instruction, provided that it measures up to certain standards included in the Pennsylvania plan for vocational education.

The State Board for Vocational Education of Texas has held classes for foremen in street railway service at Fort Worth for several years. Similar classes have been held under the leadership of the foremen of the El Paso Street Railway Company and in Houston and Galveston. The requirements of the steam railroads are so similar that it would seem that such help could readily be extended to them.

The State Board of Education of Virginia has been giving courses on foreman training in industrial sections in that state and is prepared to serve the railroads in a similar manner, if the schedule and its facilities will permit.

The State Board of Vocational Education of Wisconsin stands ready to assist the mechanical departments of railroads in promoting foremanship training. The Extension Department of the University of Wisconsin has co-operated with the industries in a correspondence study department and is prepared to render similar service to the railroads of that state.

The Division of Vocational Education of the Department of Education of Wyoming is planning on organizing a foremanship training class at the railroad shops at Cheyenne next fall.

Leadership for foremanship discussions

Two difficulties present thmselves in starting and conducting foremanship clubs or leadership classes. One is to obtain a leader and the other, inter-related with it, is to build a satisfactory program or select the right kind of a course. The *Railway Mechanical Engineer* has been asked asked these questions many, many times during the past year.

To meet this need certain more or less experimental intensive courses were put on last summer, the object of which was to train men to lead such groups. One such course, for instance, which extended over seven days, was given under the direction of the Industrial Department of the Y. M. C. A. at Silver Bay, N. Y. Another one was

given at the State Normal School at Oswego, N. Y., by the New York State Department of Education, Division of Vocational Extension Education. Both of these intensive efforts to train conference leaders met with considerable success.

The Industrial Department of the Y. M. C. A. has announced plans for a similar conference, to be held at Silver Bay on Lake George, N. Y., August 20-26, under the leadership of Prof. N. C. Miller, now director of the Industrial Extension Division of Rutgers University. Professor Miller built up the Industrial Extension Department of State College, Pa., and has personally organized and taught over 80 different foremen's groups. Some of the men who took the course last year are giving excellent accounts of themselves in conducting discussions at foremen's clubs, or heading up classes in foremanship conducted on the conference plan.

The Division of Vocational Extension Education of the New York State Department of Education has followed the course to prepare conference leaders, which was given last year, by several other intensive courses. One of these at Troy, N. Y., covered nine days and is being followed up by further assistance to those who participated in it. Another course at Utica, N. Y., includes five-hour periods one evening of each month, after which the group will meet daily for one week, in order to complete the course. It is believed that the intensive courses, such as the one given at Troy, are more productive, and the expectation is that such courses will eventually be lengthened to cover a period of as much as three weeks. A three weeks' course will be given at Oswego, N. Y., this summer, covering five hours of conference work each day and requiring about two hours of outside preparation. This work is under Arthur L. Mann, supervisor of industrial education, Albany, N. Y.

An intensive school for training conference leaders is now in session in Omaha, Nebr., under the direction of the Department of Vocational Education of the State of Nebraska. The mechanical department of the Union Pacific has entered a number of its foremen in this course, with the expectation that several foremen's classes will be formed to function under their direction, or at least with their co-operation. The conference is being conducted by Frank Cushing, chief of the Industrial Education Service of the Federal Board for Vocational Education. The purpose of the course, extending about a week, is (1) to make available to those who may attend the special knowledge that has been secured concerning successful methods of carrying on foremanship courses, and (2) to develop ability on the part of those who attend successfully to plan and conduct foreman conferences. A general outline of the course follows:

General Outline of Course

The following is a general outline of the course:

1. An analysis of a foreman's job in terms of responsibilities.
2. Classification of responsibilities with respect to—
   a. Stock.
   b. Operations and processes.
   c. Tools and equipment.
   d. Men.
3. Classification of foremen's responsibilities under the three major headings:
   a. Supervision.
   b. Management.
   c. Instruction.
4. Methods of conducting conferences—How to promote, direct and control discussion.
5. The determination of objectives.
6. Different methods of job analysis and the use of job analysis in connection with foreman training.
7. The use of analytical methods in connection with conference work.
8. The case method.
9. The development and use of auxiliary instructional material.
10. Planning—
    a. A series of conferences.
    b. A single conference.
    c. Planning on the job with respect to unexpected developments.
11. Plant organization and the foreman's relationships in the plant.
12. The foreman as an instructor.

The Estes Park (Colorado) Y. M. C. A. Industrial School has held an annual school for industrial, railroad and business executives during the past four years. The State Board for Vocational Education of Colorado has assisted in putting on a series of demonstration conferences at this school.

The fifth annual school for industrial, railroad and business executives will be held at the Y. M. C. A. conference grounds at Estes Park, Colo., July 18-24. It will be interrelated with the sixth annual Conference on Human Relations in Industry, which will be held July 23-25.

This year the Division of Industrial Education of the Colorado Agricultural College is planning several foremanship conferences; a special effort is being made to interest the railways in this development.

The state supervisor of industrial education under the Colorado State Board for Vocational Education, will conduct an intensive course on leading foremanship conferences or discussions July 9-17, this year.

King, Robinson Company, Buffalo

The Buffalo Council of the Lackawanna Supervisors held its annual banquet on April 10, 1926

Human relations conferences

For a number of years the industries in general have profited greatly from annual conferences on human relations in industry, held under the auspices of the Industrial

Department of the Young Men's Christian Associations. Such conferences, extending over a week-end period of three or four days, include representation from all of the various elements which go to make up an industry, from the financier and executives to the workers. The speakers and conference leaders include representatives of all of the various factors involved in industry, as well as experts on economics and other related subjects. Great care is taken to keep the discussions on a constructive basis and in line with Christian principles. While the discussions frequently are lively and spirited, the net result has been to get the so-called conflicting interests closer together. Such conferences have been warmly commended by all those who have had an opportunity of attending and taking part in them, regardless of their affiliations.

While railroad representatives have frequently been included among the speakers, the railroads in general have not awakened to the value of these conferences. It is significant, however, that for two years delegations from the Union Pacific attended the conference at Estes Park, Colo., and last year delegations made up of representatives of both the managements and the workers from the Chesapeake & Ohio attended the conferences at Blue Ridge, N. C., and Silver Bay, N. Y. Those who were fortunate enough to be included in such groups have expressed themselves enthusiastically over the benefits which they have derived in getting a better conception of the fundamentals involved in relationships between the employees and the managements, and the inspiration which they have received, looking toward constructive measures for improving such relationships.

The seventh annual Southern Industrial Conference on Human Relations in Industry will be held at Blue Ridge, N. C., this year, July 16 to 18. (E. G. Wilson, 412 Palmer Bldg., Atlanta, Ga.). The sixth annual conference at Estes Park, Colo., will be held July 23 to 25. (Chairman, N. R. McCreery, manager, Colorado District, Great Western Sugar Company, Denver, Colo.). The ninth annual conference at Silver Bay on Lake George, N. Y., will be held August 26 to 29. (Chairman, Arthur H. Young, Industrial Relations Counselors, Inc., 165 Broadway, New York.) The conference at Estes Park last year was attended by more than 400 people, the one at Blue Ridge, N. C., by nearly 400, and the one at Silver Bay, N. Y., by 600.

Co-operative meetings

Some of the mechanical superintendents draw attention to the pronounced effect of so-called co-operative meetings between representatives of the workers and representatives of management in ironing out difficulties which have confronted the supervision. The suggestion is also made that such meetings have done much to stimulate the foremen and supervisors to improve their leadership ability. This is said to be true with the various examples of employee representation, as well as with the labor union form of co-operation.

New Haven educational plan for foremen

The mechanical department of the New York, New Haven & Hartford, feeling the responsibility of more definite instructions and better training methods for the foremen, has had in effect for the past 18 months a unique plan quite different from that now followed by any other railroad. The greater number of the foremen are, of course, located in fairly large groups at central points, but many of those in enginehouses, repair yards and smaller terminals are widely scattered in small groups. It was therefore felt that the educational plan should be sufficiently flexible to include all of the foremen and supervisors, even at the most remote points. Indeed, it was thought that the latter were in even greater need of assistance and encouragement than those at the larger points.

It was recognized that any plan of instruction, to be effective, must be intimately related to the man's work; it must be interesting and should stimulate him to think and study. It is one thing to ask or order a body of men to study, but quite another thing carefully to work out a plan which will catch the interest and inspire the men to study—in other words, the plan must be such as to get the hearty co-operation of the foremen. Men working by themselves get into ruts and become narrow-minded. It was thought, therefore, that an endeavor should be made to give each foreman the opportunity of observing and talking over with other foremen the methods and practices at other points. An effort was also made to develop a plan which would insure as permanent results as possible.

The plan as now in effect is three-fold, including (1) monthly examinations, (2) monthly talks on foremanship and leadership, and (3) periodic visits of foremen to other terminals on the railroad.

(1) Monthly examinations. Each month ten questions each are prepared for a dozen different crafts, such as machinist, boilermaker, blacksmith, air brake, car, etc. These questions are based on the particular craft to which they apply, but also include more general matters pertaining to mechanical department accounting, the stores department, the bonus system, Mechanical Department Association rules, etc. Some of the questions are also based on the Interstate Commerce Commission rules and instructions for the inspection and testing of locomotives and tenders and their appurtenances, the American Railway Association rules, and the New Haven permanent instructions and folio sheets.

The question papers are sent to the foremen about the first of each month and the answers must be returned not later than the 25th, all answers being in the men's own handwriting. A series of examining boards has been set up, the chairman of these boards being the chief mechanical inspectors or staff officers in charge of special classes of work. For instance, the chief mechanical and electrical inspectors are chairmen of committees which have to do with papers on steam or electric locomotive machinery. The supervisor of boiler inspection and maintenance is chairman of the board which examines the papers on boilers, the supervisor of auxiliary equipment on those which relate to air brakes, the supervisor of equipment lighting on questions pertaining to locomotive and car lighting, and the general Oxweld inspector on questions relating to welding.

After the papers have been examined and marked they are returned to the foremen, together with a printed copy of the correct answers. They can thus check their papers with the correct answers. A record card is kept for each foreman, showing his marks and the numbers of questions which were incorrectly answered. If a foreman falls below a certain mark, steps are taken to determine just where he is weak and to assist him to overcome the weakness. One result of these examination papers has been the stimulation of much interest and discussion among the foremen; this interest is reflected also in the increased number of questions which are asked of the staff officers as they come in contact with the foremen. Since the questions concern largely rules, practices, etc., relating to the specific work of the particular foreman, the correct answers are valuable for reference purposes.

(2) Monthly talks. Each month a talk is given at the larger and more important shops and terminals on foremanship and leadership. A printed copy of the address is afterwards distributed to each foreman so that he may give it further study. Opportunity is also given for a discussion after each address. Incidentally, after a rea-

sonable time has elapsed, questions based upon information in these addresses is included in the monthly examination papers. The result has been a better understanding on the part of the foremen of the fundamental principles of foremanship and leadership.

(3) **Periodic shop visits.** The New Haven practice in this respect is fully outlined in the following section entitled "Visits to Other Shops."

Visits to other shops

Several of the railroads are now making it a more or less regular practice to have shop supervisors and foremen visit other shops at such times as may be most convenient. The advantages of such visits, whether they are to shops or repair plants on other roads or different terminals on the same road, are obvious.

The New York, New Haven & Hartford, for about a year and a half, has established a program of periodic visits, the shop foremen being sent to various enginehouses, and the enginehouse foremen to repair shops. Primarily, the purpose is to get the foreman away from his particular shop or terminal for the purpose of observing conditions and methods of doing work, and discussing with other foremen the various problems encountered. The conditions in the repair shop and the enginehouse vary to so great an extent that it is believed that the foremen get more from their visits by studying the different type of work. The foremen are required to submit written reports, giving their observations and making suggestions for changes or improvements. These reports are sent to headquarters and carefully studied.

Such visits have brought about better understandings between the different parts of the organization and have been found to be far more effective in correcting improper conditions and misunderstandings than correspondence; in addition, they have done much to stimulate thinking along constructive lines.

Apprenticeship as a fundamental basis

More and more mechanical department officers are coming to emphasize the value of a thorough apprentice training as a sound basis upon which to develop a successful foreman. A modern system of apprentice training not only makes a good craftsman, but it should give the young man a broad understanding of the importance of the railways and not only of his relationship to his department as a whole, but the part which his department plays in the operation of the railroad. He should also gain some conception of his relations to his fellows and to the community. This is a splendid foundation for a foreman or supervisor, if he has the right sort of a personality and will study to develop leadership ability. It is not to be wondered at, therefore, that several mechanical superintendents emphasize the necessity of a thorough apprentice training as a prime requisite for a successful foreman.

Foremen's relation to apprentices

The foremen are naturally intimately related to the apprentices. On some roads they are frequently called upon to meet with the apprentice and A. R. E. B. clubs to talk to and counsel with the members.

On the Missouri-Kansas-Texas the foremen are honorary members of the apprentice clubs. The practice on the Chicago Great Western is to assign the foreman to prepare papers to be read before the apprentices. These assignments are made by the shop superintendent or general foreman and papers are presented at least twice a month, sometimes more frequently. The apprentices are invited to ask questions after the foreman has given his talk. This is not only very helpful for the apprentices, but is splendid training for the foreman. In preparing his paper he must go into his topic thoroughly and think it through, and must study to express himself in such a way as to be clearly understood. This is excellent practice, particularly since the boys are pretty keen in asking questions and the foreman must be fully prepared when he appears before them.

Technical publications and books

On a number of roads the foremen are either encouraged to subscribe to a technical publication in their field, such as the *Railway Mechanical Engineer,* or are required to report upon articles in such publications to which their attention has been specifically directed.

On the Delaware & Hudson the mechanical superintendent requested each supervisor and foreman to prepare a written comment on the articles by "Bill Brown" and "Top Sergeant," which were published in the *Railway Mechanical Engineer* some months ago in connection with the competition for the best articles on the responsibilities and opportunities of the foremen. These papers—nearly 200—when copied and bound, formed several imposing volumes and have been the basis of a series of talks by the mechanical superintendent to the superiors and foremen.

The number of good books relating directly to railway mechanical department practices and to questions of management are rapidly increasing. The foremen should be encouraged to read and study these books and more attention should be given to building up libraries of such books at the various points.

Convention attendance

More and more foremen are being encouraged to attend conventions and to participate in the preparation of the committee reports and in the discussions. Contact with men of their own crafts from other roads has worked wonders in developing some of them. These conventions should not be regarded as vacation trips. Many managements feel that it is an excellent investment to send foremen to such meetings at company expense. In such cases the men are frequently requested to report on those things which made a special appeal to them as being best suited to the solution of their own problems. In asking for such reports it is just as well to specify that a complete detailed report of the meeting is not required, but rather a clear-cut statement of those things which appealed to the foremen as having a real value as applied on his own road.

Conclusions

This study covers in general what we believe to be the more important factors which are involved in assisting the foreman and supervisors to develop that standard of leadership ability which is so necessary in these days if we are to operate most efficiently and with the greatest economy. Obviously the nearness of attainment to this objective will depend upon the extent to which cordial co-operation can be induced between the workers and the managements and friction removed. Leadership ability on the part of the foremen is thus just as important as lubrication to a machine.

Doubtless some things may have been overlooked in this survey. There may be in process in the mechanical departments of the railroad's important developments in foremanship training which have escaped our notice. It is our purpose to publish a further article on this subject in the September number of the *Railway Mechanical Engineer,* which will gather together such things as our readers may find that we have overlooked in this study or developments which may take place after this material was compiled. The co-operation of our friends and readers in thus rounding out and completing this survey will be greatly appreciated.

Final painting and stenciling operations are done outside the shop

Wabash builds steel car shop at Decatur

Modern plant with track space for 66 cars and potential output of 15 cars a day

ON February 15, repair operations were started in the new steel car shop of the Wabash, recently constructed for that road at Decatur, Ill., by Dwight P. Robinson & Co., Inc., New York. With modern crane and machine equipment and track space for 66 cars, the shop is capable of organization for an output of 15 rebuilt cars a day. While production to date has not nearly reached this figure, owing to the employment of a relatively small force of men on steel car work, commendable results have been secured, with all indications pointing to steady improvement as the new facilities are more fully utilized.

For purposes of comparison, the following figures are

One of the 25-ton cranes which save time and labor in handling heavy steel car parts

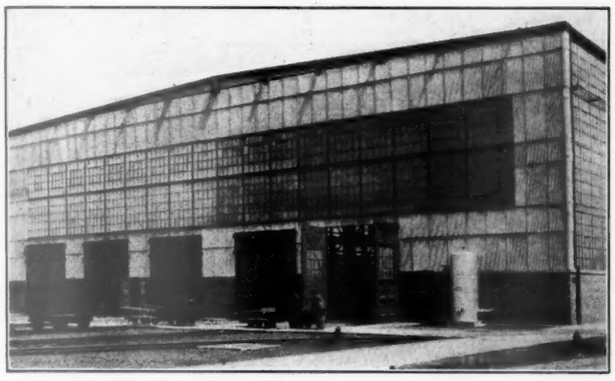
of interest. In January, 1926, 38 steel hopper cars were repaired in the shop yard at Decatur without any shelter. Twenty-seven cars of the same series were repaired in the new shop during the last half of February with reductions of 16.5 per cent in labor and 18.2 per cent in material costs per car from the figures in January when the work was done in the shop yard. In March, 76 of these cars were turned out of the new shop with reductions of 21 per cent and 32.9 per cent respectively, from the January figures for labor and material costs. The reason for the considerably improved labor showing in March over February is explained by increased familiarity of the men with the power riveting machinery, and a general checking and tightening up of operations on each car. The reduction in material costs was due to the large amount of straightening work made possible by the oil furnace, face plate and pneumatic clamp installed in the steel shop. Heretofore a considerable amount of angle iron was scrapped on account of the great cost of straightening which exceeded the cost of new material. Modern facilities for straightening angle irons and other structural shapes have made possible a material reduction in the amount of new steel required.

Decatur center of coal and grain districts

Decatur was selected as the site of the new steel car shop because, being in the center of the coal district and also the grain district, coal cars and box cars of steel design can be repaired at this point with a minimum of empty road haul. The shop was designed to meet every modern condition encountered in rebuilding steel freight equipment on a production basis at low unit cost. The shop building, of brick and steel construction with a large proportion of window area to assure adequate light, is 594 ft. long by 126 ft. wide, having a total floor area of 74,824 sq. ft. It is heated in winter, being kept as nearly as possible at a temperature of 50 deg. F. The building is 41 ft. 11 in. high, with a height from the floor level to the bottom of the roof truss of 33 ft. 4 in. and 25 ft. from the floor level to the bottom of the traveling cranes. This distance of 25 ft. under the traveling cranes permits car trucks, steel sides and other parts to be handled safely over the tops of cars.

The shop is divided into two longitudinal bays, each having a Niles 25-ton crane traveling east and west the entire length of the shop. Three tracks in the north bay are equipped with permanent scaffolds for the repairing of steel coal cars and steel underframe box cars. The

scaffolds are of unusual width to facilitate easy work and handling of material, this width being made possible by spacing the tracks 20 ft. on centers with 12 ft. between each outside track and the outside wall. The south bay,



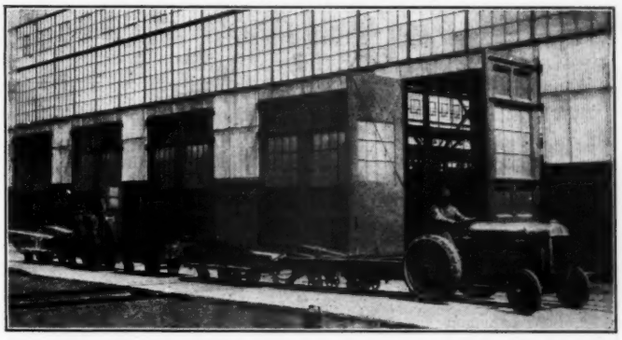
West end of Decatur car shop—A structure built of brick and steel with large proportions of window area

where steel coal cars are repaired, has two tracks running the full length of the shop and one 300-ft. track extending only to the center of the shop.

The shop machinery, located for the most part along the south wall of the building, as shown in the drawing, was not intended for fabricating all the steel parts used in the cars. It was, however, carefully chosen with a view to the expeditious handling of heavy steel car repair work and the fabrication of such parts as it was felt could be economically made in a shop of this size. The machine equipment, location and type, is shown in the drawing.

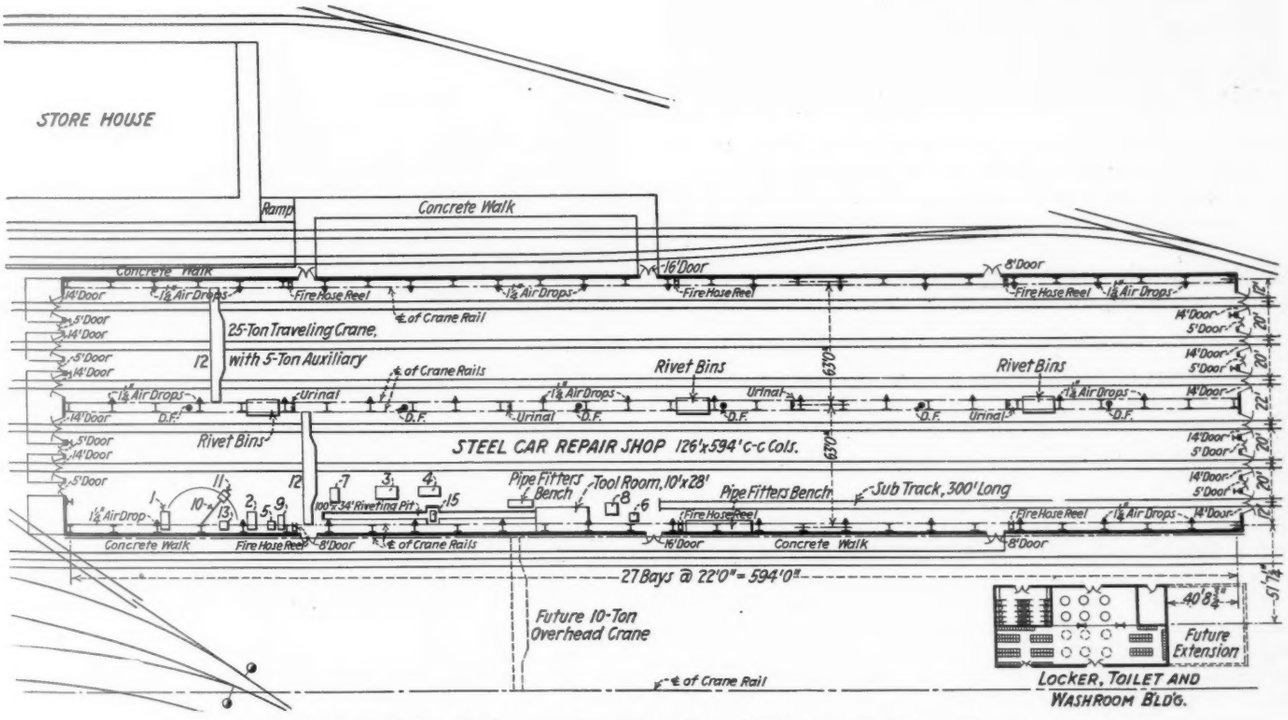
A post crane with 18-ft. boom and a portable Hanna pneumatic riveter is used in assembling and riveting the steel car sides and channels. A certain proportion of the riveting work on these parts is best performed in the 110-ft. riveting pit used in conjunction with a Hanna gap riveter with 75-in. reach and 18-in. gap, which develops pressures up to 70 tons. The Johnston oil furnace and face plate, in conjunction with a car wheel boring machine converted into a pneumatic clamp by the addition of an air clyinder, are used in the straightening and forming of car parts.

The toolroom, located in the center of the shop on the south wall, occupies a central position and performs the



An important factor in the shop output is the tractor and trailer system of handling material

important function of supplying the men with the right kind of tools, when needed. Another feature of the shop is the location of a small cut-off saw and a rip saw near



Layout of the steel car repair shop of the Wabash at Decatur, Ill.

Mach. No.	Description	Motor hp.	Mach. No.	Description	Motor hp.
1	Pels single and vertical punch	5	8	Fay & Egan iron frame ball bearing rip saw	7½
2	Pels combined shear, bar, angle and tee cutter	15	9	Niles-Bement-Pond sliding head drill	5
3	DeRemer-Blatchford Economy type oil-burning furnace	5	10	Wabash post crane with 18-ft. boom	..
4	Wabash cast iron face plate	..	11	Hanna gap riveter, 12⅞-in. cyl., 18-in. reach, 15-in. gap	..
5	Niles-Bement-Pond double grinder	3	12	2—25-ton Niles cranes with 5-ton auxiliaries	117 each
6	Fay & Egan inverted swing cut-off saw	7½	13	Johnson oil rivet heating forge	..
7	Pels triple gag punching machine	5	15	Hanna riveter, 75-in. reach, 18-in. gap, 70-ton pressure	..

the toolroom to save time going to the mill room to rip or cut off the limited amount of lumber used in this shop.

Three rivet bins located at intervals along the center of the shop save time and labor in keeping an adequate supply of rivets always available when needed. The shop is provided with numerous 1¼-in. air drops at convenient locations and also a number of drinking fountains and urinals.

Material handled by tractor and trailer system

The expense of handling other material has also been reduced to a minimum by delivering it to the shops in large quantities, by means of two Rex Ford tractors and six trailers, avoiding as much as possible unloading on stores department platforms and re-loading for shop delivery. Concrete walks and platforms 10 ft. and 12 ft. wide are provided and enable tractors and material cars to pass each other without getting off the walks.

Another feature is the unusually well-arranged and clean locker, toilet and wash room located as shown in the drawing. This building is provided with steel lockers for the men's clothing, six Bradley wash fountains in which ample warm water is available for washing purposes, and a series

Close-up view of combined splitting shear, bar, angle and tee cutter; Also Hanna portable riveter suspended by Ingersoll-Rand pneumatic hoist from post crane and used in conjunction with assembly jig mounted on rollers

of plank benches kept scrupuously clean for use of the men while eating their noonday lunches.

Method of carrying on work

Two series of hopper cars, principally being worked at the present time, are receiving all new side and end sheets. The cars are stripped on an outside track, all the top and bottom angles, side stakes, tie bars, etc., being placed in the cars which are then switched to the repair track. The cars move in at the west end of the shop and are handled through the shop by the progressive system, being turned out at the east end with painting and stenciling work done on an outside track.

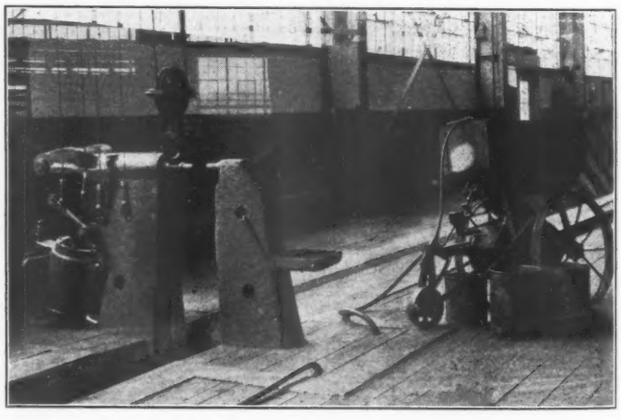
On arrival in the shop all bent angles, stakes, tie bars, etc., are removed from the cars and taken to the straightening furnace or fitting-up bench. Steel coal car side sheets, posts and angles are assembled on trestles and then taken with the traveling crane to the riveting pit where the unit is handled by an electric crane built over the pit. The entire coal car steel side sheets are riveted. The traveling crane then takes the entire side to the car where it is placed in position and the remaining rivets applied.

On steel and single sheathed box cars, the side sills, side plates, side posts and braces are assembled in a jig on special trestles with rollers designed to receive this jig. The riveting of the side frame is done by the portable Hanna riveter and the frame is then placed in position on the car by the traveling crane. The purpose of the jig used in riveting all large parts of steel equipment is to keep each sheet square so there will be no question about

Assembly jig mounted on special trestles with rollers and used for alining side frames—Rivets are driven by a portable Hanna riveter hung from post crane in background

fitting or loss of time when the frames are applied to the cars.

The handling and repairing of steel cars and steel parts is being done in the shop at a great saving over the old method of performing this work in the open with practically no facilities. In repairing cars in the open without any shelter, all material had to be handled by hand and also applied to the cars by hand. Scaffolds had to be built around each car and practically all the riveting and reaming done from these scaffolds. In the new shop, per-



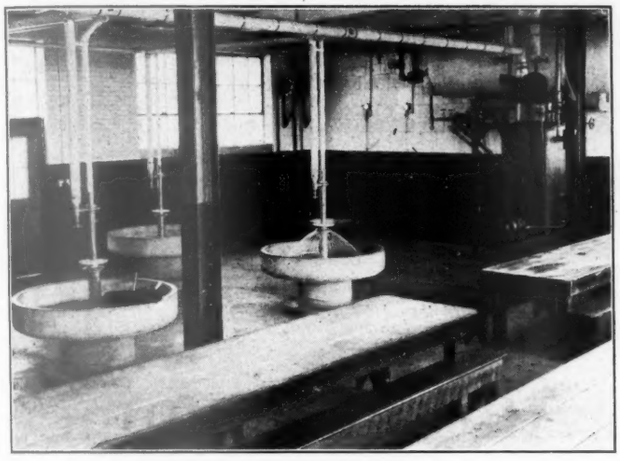
Hanna 70-ton gap riveter and section of 110-ft. pit used in riveting car sides

manent scaffolds, crane service and electric truck service take the place of hand work formerly done on the outside tracks.

At the present time the steel car repair force consists of 54 men, namely, 36 steel car repairers, 12 helpers, 5 laborers and an overhead crane operator. Seven of these men are being used for stripping the car parts that have to be renewed. After this work is done on the outside of the car repair shop, the scrap material is handled and loaded by a crane into cars ready for shipment. Twelve men work the trucks, draft gears, air brakes, brake rigging and adjust hopper doors. Six men are used in fitting up side sheets and reaming holes, getting side sheets ready

for the power riveter. This power riveter is manned by 5 men, 2 car men and 3 helpers. Three men are on the straightening fire, straightening top and bottom angles, side stakes, etc. Two men are assigned to handling finished side sheets from the riveting pit to cars with the overhead crane. Enough bolts are placed in these side sheets to hold them in place for the fitting and riveting gang which finishes the car. Twelve men do all the fitting, reaming and riveting at the car. Five laborers are assigned to bringing in material, taking side sheets from the riveting pit to the car and cleaning up the shop.

This force of men turned out 39 hopper cars the first 15 working days that the new shop had been in operation,



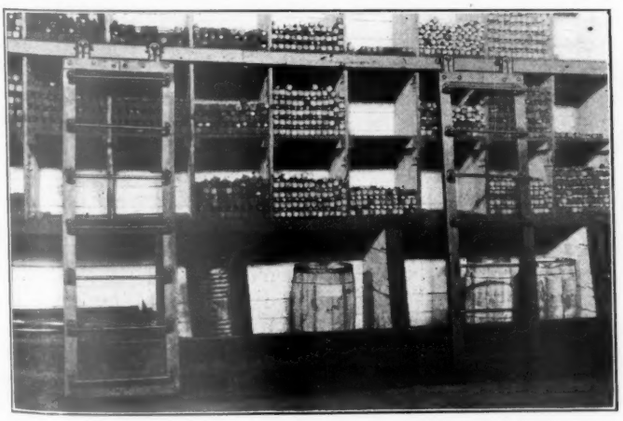
The locker, wash and lunch room is kept scrupulously clean

and this figure has been increased as the men became more familiar with the new method of working these cars.

Switching at the shop is done with a switch engine, the cars being classified before going in the shop so that the tracks, as a whole, can be finished at about the same time and thereby not cause any delay to finished cars moving out.

Sliding ladder for stock bins

WHEN the bins in a stock section are higher than a man can reach, it is obvious that a ladder must be used. Often a ladder is not available in the immediate



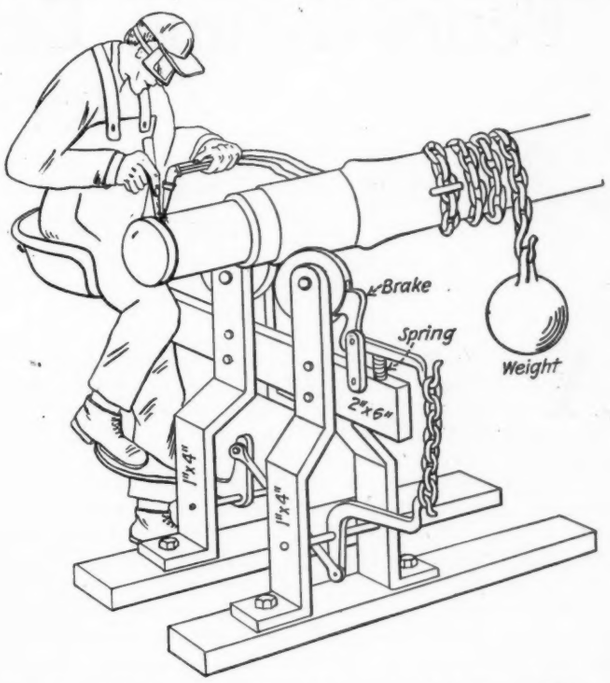
Ruggedly built stock section ladders which traverse on box car door hangers

vicinity with the result that much time is lost before one is located. This condition was found to be true in the storehouse located at the Secaucus, N. J., car repair yards of the Delaware, Lackawanna & Western. As can be seen from the accompanying illustration, ruggedly built, sliding ladders are now a permanent auxiliary to the stock sections.

The ladders are supported by two standard box car door hangers which run on a 1¾-in. by 1¾-in. by 1¼-in. Z-bar rail. The sides of the ladders are made of 2½-in. by 2½-in. angles to which are riveted seven standard box car ladder treads. The lower end of the ladder does not slide along the floor but is about 2 in, from the floor and slides along an angle iron which is secured to the top of the stock section base-board. This feature is an improvement over the common practice of the bottom of the ladder running on rollers which would not pass over nuts, bolts or any other material that may happen to be on the floor. The ladders can be moved with little effort.

Device for turning car axles when welding collars

IF the proper facilities are not provided, it is difficult to turn a heavy axle when building up a worn collar by the gas welding process. In order to obtain the best results the metal must be put on without any interruptions. For the operator to do this, the axle must be arranged so that he can turn it with ease, which can be done with the



A device which enables the welder to control the rotation of the axle with his foot

arrangement shown in the illustration. Each end of the axle rests on two rollers each held between two 1-in. by 4-in. plates securely bolted to wooden beams. To one end of a 2-in. by 6-in. iron plate is attached a seat for the operator. Under the seat is located a foot pedal which operates a series of levers attached to one of the rollers which acts as a brake. A chain is wrapped several times around the axle to which is attached a weight. When the welder wants to turn the axle, he releases the brake, which allows the weight on the end of the chain to pull the axle around to working position.

The East Altoona enginehouse showing the section of the house in which 18 stalls have been lengthened 30 ft.

Pennsylvania East Altoona engine terminal

Over 200 freight locomotives turned daily—Has shop facilities for heavy running repairs

Part I

A FEW miles east of the corporate limits of Altoona, Pa., is located the East Altoona freight engine terminal, the largest on the Pennsylvania Railroad and reputed to be the largest on the American continent. It covers 57.2 acres.

During the month of December, 1925, with a total working force of 1,134 men, 6,472 locomotives passed over the four inspection pits, 7,239 fires were cleaned, 118,139,500 lb. of coal and 2,192,720 lb. of sand were handled at the coal wharf. Power was furnished for 1,656 east bound trains and 2,221 west bound trains. The number of locomotives receiving boiler wash certificates was 206. A total of 7,654, or a daily average of 246 locomotives were dispatched during the month.

These engines, of Santa Fe, Decapod, Mikado and Consolidation types, ran into the East Altoona terminal from eight divisions. These divisions which are grouped in the lower section of western Pennsylvania between Harrisburg, Pa., and Pittsburgh, include the Pittsburgh, Monongahela and Conemaugh divisions which constitute all of the Western Pennsylvania Grand Division of the Central Region; the Middle, Tyrone and Cresson divisions which are three of the five divisions making up the Eastern Pennsylvania Grand Division of the Eastern Region and the Williamsport and Elmira divisions two of the four divisions of the Central Pennsylvania Grand Division also a part of the Eastern Region. A study of the accompanying map of these eight divisions shows that the East Altoona terminal is centrally located with respect to the territory which it serves.

Inspection and ash pits and coal trestle

The four inspection pits, two on each side of the coal wharf trestle, are located at the west end of the terminal layout. These tracks are 90 ft. long and are provided with concrete pits. The main inspection pit service building, which is two stories, 42 ft. 9 in. by 10 ft. 6 in., is located along the north side of the inspection pits. This building is used by the supervisory force and by the inspectors and enginemen to make out their work reports. One terminal of the pneumatic tube used for sending the work reports to the enginehouse office is located in this building. A telephone is also located here for communication to various points in the terminal layout. Under the trestle of the coal wharf approach is located a smaller inspectors' building and a material building in which is kept a complete stock of small material and engine supplies. A list of all the material in stock is posted in this building. Also located under the approach to the coal wharf is the apparatus for mixing the oil and water used for cleaning the locomotives before they are placed on the pits. Oil faucets from which lubricating oil, signal oil and kerosene are drawn, are located outside of the east end of the main service building.

The four parallel water ash pits, 240 ft. long and 4 ft. 6 in. deep are located, two on each side of the coal wharf

trestle. A cinder car track is located between each group of two ash pits. A five-ton capacity traveling crane is located over each pair of ash pits and their cinder track. The pits are cleaned out by means of a clam shell bucket. Five hydrants are located to serve each pair of ash pits. A service building, 22-ft. 6-in. square, is located under the coal wharf trestle for the use of the staybolt inspectors and ash pit men.

The 1,200-ton capacity coal wharf is of the wooden tipple design with 30 coal chutes, 15 on each side. A

This trestle has a capacity of 1,200 tons of coal and 2,500 tons of sand

storage capacity for 2,500 tons of wet sand is available underneath the wharf and the trestle approach. The sand is dried by steam in a steel box approximately 12 ft. long, 5 ft. wide and 3 ft. deep, equipped with three staggered rows of steam coils. The sand is conveyed to the steam coils by a conveyor system, and as it dries, sifts through two screens, one of which is ¼-in. mesh and the other 1/16-in. mesh. The sand then passes into a tank from where it is elevated by air into a large storage tank located on top of the wharf. A sufficient supply of sand is dried

Looking up the coal trestle approach on each side of which are two inspection pits

by one laborer in eight hours to last for the remaining 16 hours.

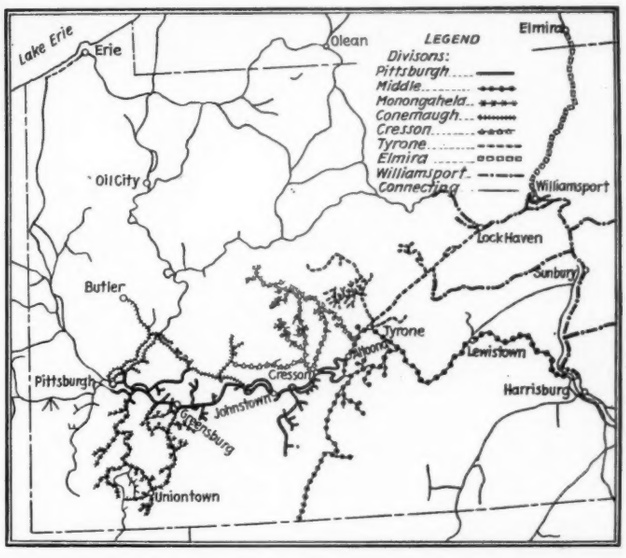
The west bound cabin storage tracks are located along the north side and the east bound along the south side of the coal wharf.

The enginehouse

The enginehouse is a complete circle containing 50 stalls, and a run-through track all of which is served by a 100-ft. turntable. When the enginehouse was first built, the 90-ft. stalls were long enough to hold the largest locomotive then in service on the Pennsylvania with sufficient allowance for larger locomotives of the Consolidation type. With the advent of the Mikado type, the capacity was reached and when the Pennsylvania built its Decapod locomotives, the 90-ft. stalls were not sufficient to hold a Decapod locomotive and at the same time be able to close the circle doors or to spot the locomotive at any point on the wheel circumference for rod work, etc. As a result of these conditions, work was started in August, 1925, to lengthen 18 stalls, 30 ft.

The work required the removal and rebuilding of the old walls, roofs, etc., together with the moving of a 183,000-gal. water tank, 30 ft. and the relocation of several tracks. The jacking walls of the new pits were built 2 ft. 7 in. wide and 35 ft. 9 in. long, the purpose being to reduce to a minimum the damage to the enginehouse floor through the use of jacks. The new pits, as well as the old ones, are equipped with a blow-off system connected to the sewer.

A two-ton jib crane has been installed near the front



Map showing the eight divisions from which the power enters East Altoona freight terminal

end of each of the 18 long tracks and this, in addition to the present one-ton jib cranes now in place, will permit the use of four cranes around each locomotive.

The enginehouse, as it now stands, has 18 stalls, 120 ft. long and 32 stalls 90 ft. long. The outside radius of the enlarged portion is 228 ft. 3 in. and the remainder, 198 ft. 3 in.

The four electric drop tables used for dropping driving, engine truck, trailer and tender wheels are located in the pits facing the wheel storage yard and machine shop. There is one 24 ft. drop table and one 55 ft. drop table on which all the driving or tender truck wheels can be dropped at one time, and two 8-ft., double-end tables for handling trailers and single pairs of driving wheels.

Convenient offices for the supervision are located throughout the house. In addition, there is a large office for the boiler and machinery inspectors and the assistant enginehouse foreman.

Machine and blacksmith shop

The machine shop, blacksmith shop and circulating tool room are located in a building 70 ft. by 162 ft. 9 in. Table I is a list of the machine tool equipment in the machine

shop which makes it possible to refit main and side rods, make all wheel repairs and handle other work, such as driving boxes, which in many large terminals are handled in an adjacent back shop. In addition, air brake equipment, injectors, steam gages and other similar parts are repaired and tested. A fully supplied and well maintained tool room is located at the southwest corner of the machine shop. During the first trick three machinists are engaged in the tool room making repairs on hydraulic jacks, oil furnaces, air tools and other small tools. The duplicate brass check system is used for checking out tools.

The blacksmith shop is located at the eastern end of the machine shop building. It contains two steam hammers, four forge fires, one oil furnace, one babbitting furnace for crossheads, one copper brazing forge fire and one electric welding outfit. A corner of this shop is set apart for repairing electric headlights.

Outside at the east end of the machine shop is located a 19-ft. 6-in. by 35-ft. building in which headlight turbine generator sets are repaired and a building 10 ft. 8 in. by 26 ft. 10 in., is also here provided for tin repair work.

The main office building

The main office building, which is parallel to the south side of the machine shop building, is of brick construction, 161 ft. by 65 ft., two stories high. Part of the first floor is taken up with the offices of the assistant master mechanic, the general foreman, two engine dispatchers' offices (one for west bound and one for east bound power), a work chart office where the piecework charts are copied from the work reports received by pneumatic tube from the inspection pits, and the piece work chart office where the charts are prorated.

The personnel for each trick in the westbound dispatcher's office consists of two dispatchers, one work distributor and a clerk. In the east bound dispatcher's office are one dispatcher, one work distributor and one clerk. The duties of the work distributor are to check the locomotive work reports after they come from the inspection pit, take these reports to the locomotives and examine the defects reported, decide on how the work is to be done and furnish to the engine dispatchers an estimated time at which the locomotives can be ordered for service. The dispatchers notify the foremen on the storage sidings what locomotives must be ready for service at various designated times. There are also two assistant road foremen's offices on the first floor of the main office.

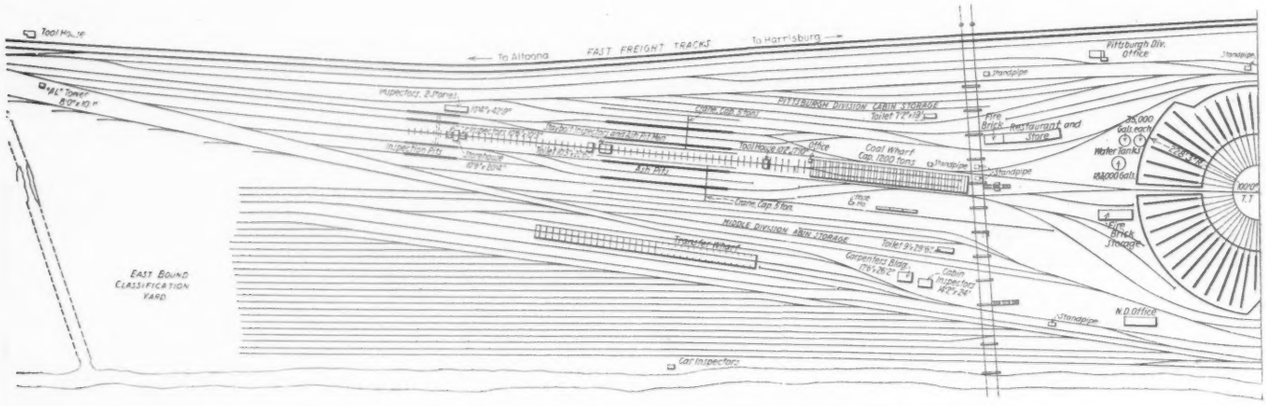
The second floor of the main office building is taken up with engine crews' bunk rooms, recreation and reading rooms and a fully equipped air brake instruction room. The equipment in this room consists of a boiler head fitted complete with the various brake equipments in use on the road, together with all the other appliances found on the boiler head of a locomotive. There is also a test rack fitted with 11 operating sets of car brakes, with additional brake pipe volume to represent an 80-car train. The room also contains cut sections or charts of practically all the parts of the air brake equipment used on the Pennsylvania Railroad together with cut sections of other locomotive appliances such as a whistle, safety valve, steam heat valve, etc.

The stores department

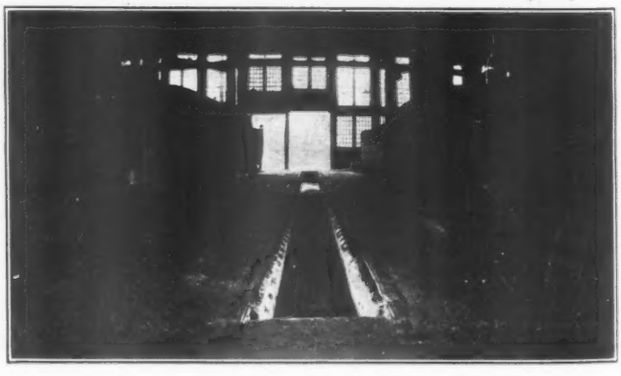
The east end of the first floor of the main office building and the basement is used by the stores department. The first floor area is 96½ ft. long and 65 ft. wide and the basement, 128½ ft. long by 65 ft. wide. The stock contains 8,800 items. The number of stores department employees for each trick is shown in the following table:

	Tricks		
	1	2	3
Stockmen	2	1	0
Clerks	1	0	0
Store attendants	11	5	3
Laborers	9	0	0
Total	23	6	3

The stores department carries a full supply of all kinds of finished main and side rods, repaired air compressors, crossheads, pistons, injectors, air brake equipment and all other parts necessary for the repairs of the various classes of locomotives handled at this terminal. A full line of parts for the maintenance of feedwater heaters, power reverse gears and stokers is kept in a separate room.



The western end of the terminal showing the inspection pits and coal wharf

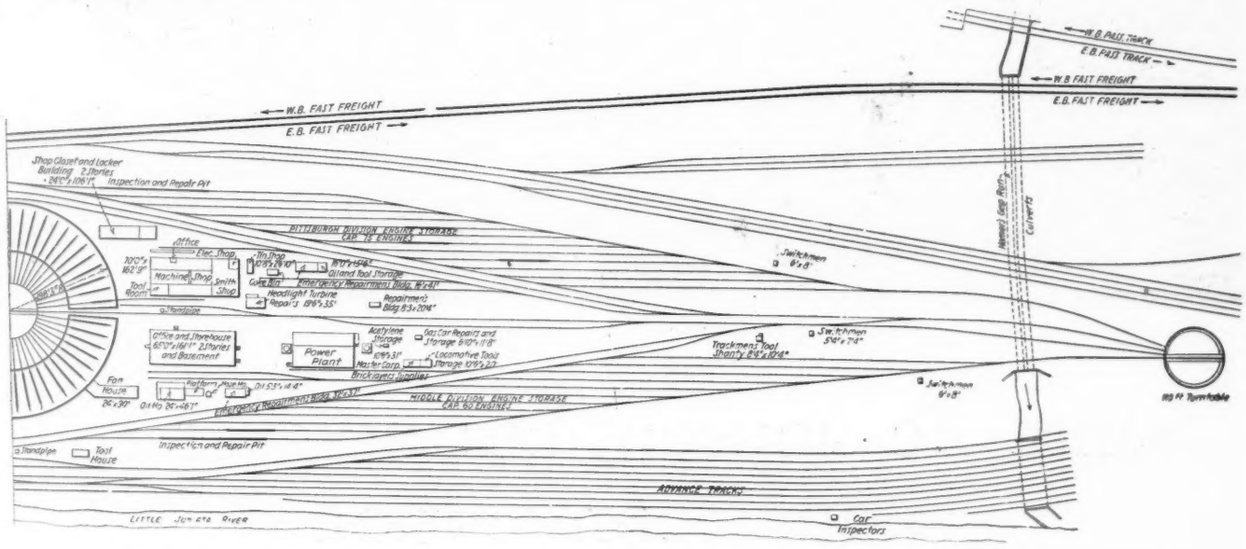


A view of one of the lengthened stalls—At the right may be seen one of the material stock bin sections

This section is well arranged and is helpful in making quick repairs to these auxiliaries.

About 5 supply cars, which come from the Altoona machine shops are handled every day by the stores department. The material brought by these cars is ordered the day before. The back shops co-operate fully with the enginehouse and give it preference when distributing material. In case the enginehouse is in need of any material in a hurry, the order is telephoned to the Altoona back shops with the result that the material is brought to East Altoona from the main storehouse by an automobile truck. An average of about $110,000 worth of material is consumed every month at the East Altoona terminal, of which $3,500 is used at the inspection pits.

A large bin section for stocks of small material is located at the inspection pits. There is a smaller section at each of the two locomotive storage sidings and there are 10 such sections at various points in the enginehouse. A typewritten list of the material carried in each section, giving the amount of each item and the number of the bin in which it is located, is placed on one end o fthe section under glass. In the morning, a stores attendant visits each section. He makes a list of the material needed and issues orders for it. In the afternoon, a stores attendant and a laborer, with an electric truck, delivers the required material to the bin sections. If any material is not furnished by the stores department, the gang foreman in whose territory the stock section is located, makes a list of the missing items and sends it to the general foreman. The latter personally checks the lists with the storekeeper in order to obtain the material needed. This system of keeping the stock bins filled is effective, as the undivided responsibility is placed directly on the stores department.



The eastern end of the terminal layout showing the locomotive storage tracks and lower 100-ft. turntable

The oil house is in a separate building along the south side of the main office building. In it are kept all necessary oils, sponging and waste used about an engine terminal. The oil cars coming directly from the main oil mixing plant located at South Altoona, are placed over the intake pipes and are discharged directly into the large supply tanks located underneath the ground from which the oil is forced through the faucets under pressure.

The 110-ft. turntable located at the eastern end of the terminal layout

(To be concluded next month.)

Table I—The machine tools located in the machine shop of the East Altoona engine terminal

Number	Description of machines
1	42-in. vertical turret lathe
1	27-in. by 17-ft. engine lathe
1	20-in. by 16-ft. engine lathe
1	30-in. by 8-ft. engine lathe
1	20-in. by 8-ft. engine lathe
1	24-in. by 6-ft. engine lathe
1	16-in. by 8-ft. engine lathe
1	Journal lathe
1	21-in. slotter
1	Duplex rod boring mill
1	10-in. by 36-in. plain grinder
1	36-in. emery grinder
1	10-in. emery grinder
1	6-in. floor grinder
1	Drill and reamer grinder
1	2-in. bolt cutter
1	1-in. to 6-in. pipe threader and cutter
1	79-in. wheel lathe
2	24-in. shapers
1	32-in. crank planer
1	36-in. by 30-in. by 10-ft. planer
1	21-in. vertical drill
1	4-ft. radial drill
1	6-in. bench drill
1	Horizontal, boring milling and drilling machine
1	100-ton hydraulic press
1	7-ton bushing press
1	7½-ton overhead traveling crane
1	Brake valve test rack
1	Pump governor test rack
1	Air safety valve test rack
1	Distributing valve test rack
1	Injector test rack
1	Superheater damper cylinder test rack

Santa Fe apprentices who attended the convention at La Junta, Colorado

Santa Fe apprentices hold third annual convention

Over two-hundred present from ten states and twenty-nine clubs

PUBLICATION of the report of this meeting, which was held at La Junta, Colo., February 22-26, was purposely delayed until this time. In the three preceding issues of the *Railway Mechanical Engineer*—March, April and May—critical articles were published going to the very heart of the railroad apprentice problem. Here is a report of a representative group of apprentices from a system which has shown a remarkable degree of confidence in developing a modern, up-to-date apprentice system—and it believes in it and its officers can tell why in no uncertain terms. This brief résumé of the proceedings of the meeting of these young men, studied in connection with the three articles above-mentioned, may be illuminating to those who are skeptical about the advantages and necessity of apprentice training.

During the past three years several conferences of younger men engaged in railway service have been held, chief among them being the Railroad Y. M. C. A. conferences at St. Louis (1923), Detroit (1924) and Pittsburgh (1925) and those conducted in 1925 and 1926 by the Chesapeake & Ohio at Huntington, W. Va. These conferences promise to mark a new era in the selection and training of young men for railway service and in inspiring them to become better citizens.

Three somewhat similar annual conventions, held by the apprentices of the Santa Fe, have proved equally inspiring and effective, although they have been restricted to mechanical department employees and to apprentices only. The first of these was held at Albuquerque, New Mexico, in 1924, the second at San Bernardino, California, in 1925, and the third at La Junta, Colorado, last February.

Conference and basket ball tournament

The Santa Fe apprentices, in a unique manner, combined a convention proper with a system basket-ball tournament. Regular convention sessions were held each forenoon and early afternoon, to listen to addresses given by railway officers and others, with general and group discussions of matters of interest to the apprentices. The basket-ball games were confined to the late afternoon or evening hours and no one was permitted to play in the tournament who did not attend the sessions of the convention. Each apprentice club on the system was entitled to send four voting delegates to the convention and to enter a basket-ball team in the tournament. No apprentice was eligible to attend who was not up to the required standard in his apprentice school classes or shop work.

These apprentice conventions are held with the approval and guidance of the Santa Fe management but conducted by the apprentices themselves. The company furnishes necessary transportation and leave of absence to those who are selected as delegates. The apprentices pay their own expenses, except where these are paid by their local clubs, shop craft associations, or from money raised locally by entertainments or by athletic carnivals. Lodging and breakfast is furnished by the citizens of the community in which the convention is held, the local chamber of commerce aiding the local apprentice club in the arrangements for the convention. The daily papers give prominent mention of the proceedings of the convention. At this convention, the La Junta *Daily Democrat* contained a double page welcome from the merchants of the city. The *Tribune* devoted one entire issue to the proceedings.

It was interesting to note that in this large gathering of boys from so many widely scattered localities, not one case of disorderly or unbecoming conduct was reported, the daily papers on the contrary remarking on the fine appearance and gentlemanly conduct of those attending the convention. They represented the cream of the apprentices of a road which has exercised great care in the selection of its apprentices and which because of the thorough training and other opportunities offered its apprentices and apprentice graduates has attracted the finest young men of the communities which it serves. It was a wonderful gathering. At one time five division master mechanics of the road were in the convention, four of whom were themselves products of the present Santa Fe apprentice system, their presence and remarks being a great inspiration to the apprentices and a convincing illustration of the opportunities for promotion open to those who prove worthy.

There were in attendance 205 apprentices from all over the Santa Fe system, coming from 10 different states and representing 29 apprentice clubs. As one speaker said, there were Santa Fe apprentices present not only from Topeka, known as the "holy city" of the Santa Fe, and from Kansas City which the radio announcer proclaims as the "heart of America," but from the far off pine groves of Silsbee, Texas, to the orange groves of sunny California; from the windy city, Chicago, to San Francisco at the Golden Gate. There were also present as guests a delegate from the apprentice club of the Missouri-Kansas-Texas at Parsons and two from the club of the Kansas City Southern at Pittsburg, Kan., on both of which roads the supervisor of apprentices is a former Santa Fe apprentice.

Sixteen basket-ball teams were entered in the tournament representing the following clubs: Winslow, Arizona; Las Vegas, New Mexico; Raton, New Mexico; Temple, Texas; Wellington, Kansas; Pueblo, Colorado; Fort Madison, Iowa; Dodge City, Kansas; Clovis, New Mexico; Arkansas City, Kansas; Newton, Kansas; Albuquerque, New Mexico; San Bernardino, California; Topeka, Kansas; Richmond, California; and La Junta, Colorado. The boys played good basket-ball, many of them having been former stars on their high school or college teams. They played hard and fast, exhibiting true sportsmanship in playing the game square that the best team might win. The various club and state yells resounded throughout the contest. Kansas proved to have the best teams, all four teams going into the semi-finals being from the sunflower state. The tournament was finally won by the team from Newton, Kansas, after a spirited contest with the team from Wellington. Suitable trophies were awarded the winning team with a silver basket-ball charm for each of the individual players on the all-star team of the tournament as picked by the referees and judges.

The convention opened on Washington's birthday with an invocation by Rev. C. W. Halsey, and with the singing of America. C. Leroy Coleman, an apprentice at La Junta and president of the Association of Santa Fe Apprentice Clubs, presided throughout the convention, and in a manner that would have been creditable in any civic organization. Addresses of welcome were given by the mayor and the president and secretary of the Chamber of Commerce. Responses to the addresses of welcome were made by delegates from the various clubs. Greetings were read from John Purcell, assistant to the vice-president and chief of the mechanical department, and other officials of the company. F. W. Thomas, supervisor of apprentices

The La Junta Chamber of Commerce made a public display of Santa Fe apprentice trophies, lesson sheets and materials

was present adding pep to the meeting and assisting where opportunity presented.

Pays to train apprentices

One of the best addresses of the convention was given by J. R. Sexton, mechanical superintendent, on the subject of "Why It Pays to Train Apprentices." He contrasted the opportunities given him while learning his trade with those offered today to the apprentices on the Santa Fe, and gave nine reasons for training apprentices. Among these are: It pays any road to train its own men; it provides a training for foremen, 95 per cent of the foremen on his district having been trained as apprentices on the Santa Fe; labor turnover is reduced as the men stay with the road that has trained them; it aids in meeting extraordinary conditions, since the apprentices can be used as a flying squadron in emergencies.

John H. Linn of the apprentice department stressed the importance of the railroad industry and of railroading as a life-calling, pointing out that it is due to the railways that the vast material resources of this country have been developed and that our people have been brought closer together and cemented into a great nation. He told of the attention given by the railroads to the selection and improvement of materials and of the even greater necessity of the selection, placement and training of the human element.

G. M. Lawler, division master mechanic at La Junta and a graduate Santa Fe apprentice, spoke on "The Opportunities for the Graduate Apprentice," pointing out the policy of the Santa Fe in promoting from its own ranks and giving concrete illustrations of Santa Fe graduates promoted. R. M. Tirey, city superintendent of schools, had for his subject "Sixteen Hours Off the Job. What Can I Do?" He allotted half of this time for sleep, half of the remaining time for meals and in getting to and from work, stating that what we eventually become depends on the use made of the four remaining hours.

Homer Hoisington, state secretary of the Y. M. C. A. for Colorado, spoke on the topic, "As an Individual What Can I Do To Become a Better Citizen?" He held up a high standard of living and urged the boys to go into athletics both for the physical benefit they will derive and for the benefit to their characters that would come from true sportsmanship. A sound body, a clean mind, clean friendships, and a Christian character are all needed to make up a fully rounded man.

R. S. Johnston, surgeon in charge of the local Santa Fe hospital spoke on "Keeping Fit." The advice he gave coming from a man in his position made a deep impression on the minds of his young hearers. Judge M. F. Miller in a patriotic address gave the delegates, "Something to Think about on the Way Home," urging obedience to the constitution and the laws of the land, respect for the flag and the principles for which it stands, and obedience to God.

There were talks also by Charles Siebrel, shop safety superintendent, and by L. F. Butler and Clyde Schaeffer, system officials of the Shop Crafts Association. One of the most interesting addresses of the convention was by an apprentice boy, R. B. Crowley of Las Vegas, N. M., who spoke on the "Training of Machinists and Apprentices for Supervisory Positions" in a manner that would have reflected great credit on any man in a supervising capacity.

Activities of apprentice clubs

At different times during the convention, the apprentices broke up into groups and talked informally about the subjects discussed in the preceding formal addresses. These group discussions proved one of the most profitable features of the convention. Then there was a discussion under the leadership of E. B. Ralph, apprentice instructor, La Junta, of the activities of the various apprentice clubs represented. A delegate from each location answered the question, "Why We Have a Club At ....." "The Trouble With Our Club," "Our Difficulty in Organizing Our Club," "The Activities of Our Club," etc. This discussion proved most helpful, the weaker clubs profiting by the experiences of those which had been more successful. One of the clubs reported not only literary and social entertainments, and athletic events, but also the staging of plays, a real wild west rodeo, a big donation to help replace a church that had burned down; another a generous donation to a local hospital fund, not to mention a monthly newspaper of its own.

Mention should also be made of the convention banquet at the Harvey House, at which F. W. Thomas, supervisor of apprentices acted as toastmaster, and also of the Convention ball, and of the luncheons served each day by the ladies of the different churches, wherein the boys entered into a spirited competitive song fest, and good natured raillery, exhibiting unusual wit and characteristic pride. The singing at the opening of each session under the leadership of Loyd Larsen was exceptionally good, making the boys feel at home and putting them in a receptive mood.

The closing day was given to a sight-seeing or educational trip, the delegates being taken in special coaches to Pueblo, Colorado, where they were the guests of the Colorado Fuel & Iron Company. They were given an opportunity of witnessing and studying the process of converting crude ore and raw material into the finished product, of seeing the manufacture of steel in various forms used in railway service, from that of a very small finishing nail to a 110-pound rail. The various steps were thoroughly explained by competent and intelligent guides. The boys were given a luncheon provided by the C. F. & I. Company, at which the general superintendent of the plant presided.

An important factor, also, is the educational value of the opportunity given the delegates to these conventions to visit other shops of the road and become more familiar with the road as a whole. The different Santa Fe cities and towns vie with each other in bidding for the conventions. At one time at the recent convention a dozen or more telegrams were received from the chamber of commerce, the daily newspaper, the superintendent of schools, the hardware merchant, the banker, and other leading men of one of the cities asking for the convention next year. Wellington, Kansas, was selected as the place for next year's meeting.

Interior view of the box car shop, Lehigh Valley, Sayre, Pa.

The drilling machine in the railway shop

Requirements for efficient operation—Jigs fixtures and practical set-ups

By L. R. Gurley

ACCORDING to an old analysis, which probably holds approximately under present conditions, 17 per cent of the machine operations in railroad shops are drilling operations. This work is handled on three types of machines; namely, the sensitive or bench drill, the vertical drill and the radial drill. There is a tendency among machine shop foremen to consider the drilling machine as a handy machine to drill holes which can be operated by any workman who knows how to start and stop it. The foreman often gives most of his attention to increasing the efficiency of the other supposedly more complicated and important machines and gives the drilling machine little attention. Attention given to the improvement of the efficiency of drilling operations will be profitable, however, because of the large variety and volume of drilling work handled in a railroad shop.

Drilling and tapping 180 holes and completing all reaming in on a new locomotive cylinder in 12 hours

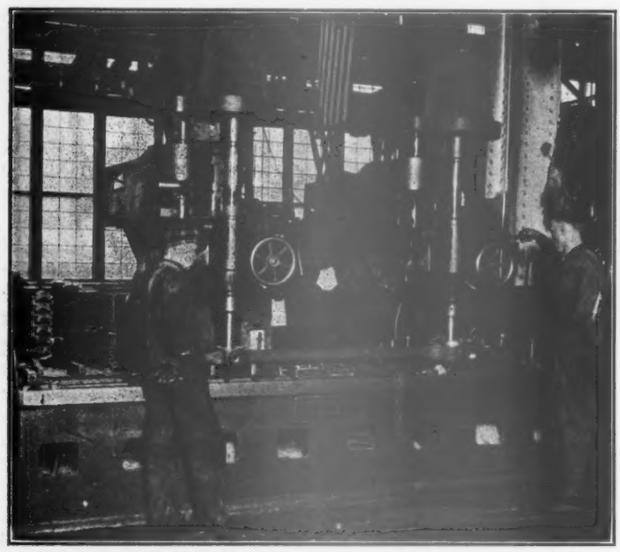
Many drilling machines at present used in railroad shops and engine terminals have unquestionably outlived their period of effective usefulness. In some cases the driving motor is too small, or the driving pulley and belt does not transmit sufficient power to operate the machine at the desired cutting feeds and speeds. In other cases the clutches and gear shift mechanism for transmitting power within the machine itself are inadequate for present-day needs. Sometimes the spindle bearings are worn, or in the case of radial machines, the head bearings on the radial arm are worn beyond the point where lost motion can be taken up, with the result that the drill spindle wabbles "like a drunken sailor." Under such conditions it is obvious that the desired results in the production of drilled holes cannot be obtained. There is only one effective remedy in such cases and that is to replace the weak or worn out machines with modern high-power drills, not forgetting that the requirements for railroad shop drilling machines are: First, adequate power for the job in hand; second, rugged design and construction to withstand the stresses encountered in this class of heavy duty work; third, convenience of starting and stopping and changing from one feed and speed to another in order to conserve the operator's time and provide increased production.

Methods of training operators

Besides providing better equipment, shop managements can improve their drilling production by the education of operators as to what the modern drill can and should produce in the way of drilled holes. The range of work usually handled on a railroad shop drilling machine requires more or less variance in methods. For this reason the training of an operator must be approached from a different angle than is the case in a manufacturing plant where

the duties of an operator on a drilling machine are purely repetitive.

Experience has shown that it is profitable first to teach an operator to handle the simpler operations on the drilling machine, such as drilling cotter holes, oil holes, and work of a similar nature. On this class of work errors on the part of the operator do not necessarily result in spoiled work. As the operator becomes familiarized with the



A double head drilling machine on which from eight to ten sets of side rod bushings are completed in eight hours

actual cutting of the drill as used in the simpler type of machine as, for example, the sensitive drill or upright machine, he may be promoted to work requiring more accurate location of the holes, such as drilling work within circles scribed on the surface. He will thus become familiar with "drawing" the hole to the proper location and acquire habits of accuracy. Work involving the use of reamers and taps serves further to educate the operator in the care of tools, in the operation of more complicated machines and in the handling of more accurate work. By a succession of such stages the operator becomes fitted to handle more complex drilling machines, such as the large radials or special purpose machines. Machines requiring the use of boring bars or sizing tools, which must be adjusted by the operator, require practically the same skill in their handling as is required for certain lathe, planer or boring mill jobs.

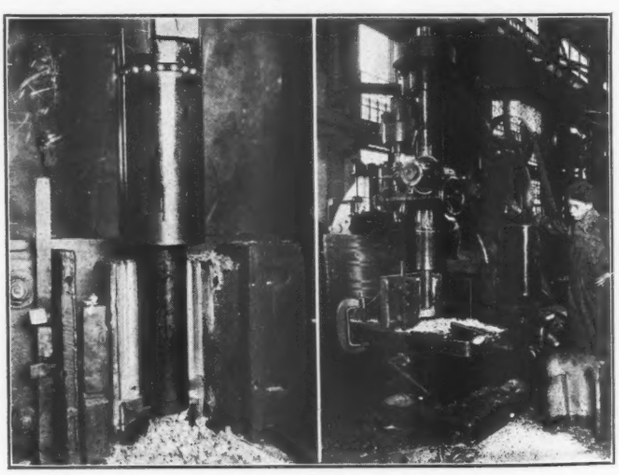
It is usually necessary to have the operator properly educated in drill grinding. This does not mean that drills may be ground by hand to give as good results as those ground in a drill grinding machine. On the other hand, unless the user of a tool knows what the condition of the tool should be, his proficiency as an operator is likely to be impaired.

Among the more important subjects with which the drilling machine operator must be familiar is the proper type of drills or tools that he may require in his work. For example, flat drills in comparatively thin pieces of brass or bronze will give very satisfactory results, while they are not so well suited for wrought iron or steel. The same principles applying to the tools used on the lathe or planer apply to the cutting angle of the drill. The thickness of the drill point has an important bearing on the output of the drilling machine. The point of the drill does not cut freely. A reduction in the thickness of the drill point means a corresponding reduction in the power required to force the drill into the work. Thinning a drill point requires good judgment on the part of the operator. If he is not sufficiently skilled, or is not provided with the facilities for performing this work, he should at least be competent to judge whether or not the point of the drill is of the proper thickness as well as to judge by the feel of the drill when feeding it into the work by hand, whether or not the tool has sufficient clearance. He should also be able to judge by observing the condition of a drill in use whether overheating is due to improper grinding, insufficient or improper lubrication, excessive feed or too high speed.

Spindle and drill speeds

One of the most vexing problems with which the foreman has to deal is that of urging the operators to keep their machines speeded up. It is not unusual to find an operator using the same spindle and drill speeds all day, regardless of the size of drills or kind of materials he may be working on. One operator may be working on a lot of gray iron castings. At the beginning of the day he will be using the correct speeds, but suddenly hits a hard spot which results in a burnt drill. He gets a new drill and slows up his machine and will continue to drill at the reduced speed until he has finished the castings, presumably on the assumption that he may hit more hard spots.

Every machine should bear a plate containing the various spindle and drill speeds at which it should be operated and the operator should be constantly reminded to use that table. A table of drill speeds and feeds is at best only a recommendation or guide. The purpose is to give a general idea of what output should be expected under certain conditions. Speeds and feeds should be increased or decreased as operating conditions warrant. The foreman should teach the operator to observe the working of the drill, to note carefully the results of each change of speed or feed, to study various methods of setting up work, to



Boring to size engine truck brasses on a Foote-Burt drilling machine

detect variation in the materials drilled and to use good judgment at all times.

Several points must be considered in estimating time for any particular piece of work. These are the machines used, the method of setting up or securing the work, the type of drill, and the condition of its cutting edges. The last point is of the utmost importance. Regardless of the capacity of the machine or the fixtures used, it must always be borne in mind that the actual work is performed at the cutting edge of the drill.

The range of work required from railway shop drilling machines makes some machines of large capacity a neces-

(1) Drilling nine holes in a switch frog in 20 min. (2) Drilling three repair parts in a three-spindle machine—Note that all the work is held by air-operated clamps. (3) A six-spindle drilling machine on which 100 valve motion pins can be drilled at both ends in 8 hrs. (4) A vertical drilling machine used to cut a keyway in a piston rod. (5) Drilling four holes in an arch bar in 10 min. (6) Cutting the wristpin holes in both ends of a side rod in 2 hrs. 10 min. (7) Scarfing a back flue sheet in 6 hrs. (8) Cutting the grease grooves in a driving box shell in 20 min. (9) Boring and chamfering a driving box in 40 min. (10) Reaming a main rod strap complete in 1 hr. (11) Boring out the cylinder of an air compressor without taking it apart.

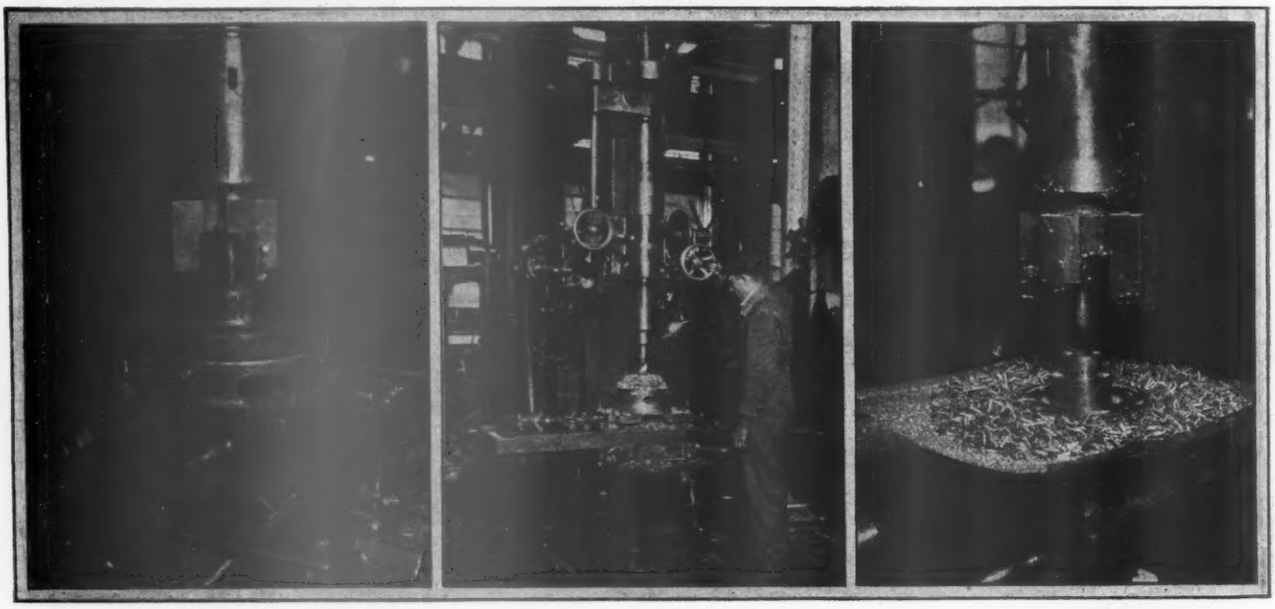
sity. One of the illustrations shows the comparative sizes of a modern locomotive cylinder and a heavy duty six-foot radial drilling machine.

Referring to this illustration, it will be seen that the cylinder being drilled is set close to the column of the machine rather than under the outer range of the arm. This rule should be observed in all drilling operations. On upright machines the results will be more satisfactory if the work is kept as near the center of the table as possible. This method avoids table deflection. Under normal conditions no perceptible spring is found in a well-built machine. Conditions other than normal, such as dullness of the drill, the drill slipping in the chuck, or carelessness in setting the work, may bring about a slight yielding that will react as the point of the drill passes through the lower side of the work. The action is similar to a sudden increase in feed and sometimes results in drill breakage.

Much valuable information has been published by the various twist drill manufacturers governing the proper selections of drilling speeds and feeds. This information should aid the foreman materially in obtaining the maximum production from his drilling machines, and every effort should be made to get it into the hands of the operators so that they will become proficient in their duties.

Very complete tables are compiled by the Morse Twist Drill & Machine Company, New Bedford, Mass., which contain information for the drilling of a variety of metals, most of which are commonly found in railroad shops. These tables, or others of a similar nature, should be in the hands of every operator. If no table is at hand and the operator is in doubt as to the correct speed for a twist drill, it is a safe rule to start carbon drills with a peripheral speed of 30 ft. per min. for soft tool and machinery steel, 35 to 50 ft. for cast iron, 60 to 120 ft. for brass, and a feed of .004 to .007 in. per revolution for drills ½ in. and smaller, and from .005 to .015 in. per revolution for drills larger than ½ in. At these speeds and feeds a good cutting compound is recommended when drilling steel. The so-called Mezzo drills, the characteristics of which lie between carbon and high speed drills, should be run at approximately double the feeds recommended for carbon drills. They should never be used in machinery steel containing over .35 per cent carbon, in hard alloy steel, chilled cast iron, or any other hard material. It is a safe rule to run high speed drills with a peripheral speed of 70 to 100 ft. per min. and a feed of .008 to .020 in per revolution in soft tool and machine steel, 70 to 150 ft. per min. and a feed of .004 to .008 in. per revolution in alloy steel, 200 to 300 ft. per min. and a feed of .015 to .020 in. per revolution in brass. This information, which is essentially the practice recommended by the Cleveland Twist Drill Company, is, no doubt, already in the hands of many readers of this article. It is so commonly neglected, however, in spite of its importance, that it will stand the repetition.

If the drill chips out at the cutting edge, there is too much feed or the drill has been ground with too much lip clearance. A drill split up the web is evidence of too much feed or of improper grinding. The failure to give sufficient lip clearance at the center of a drill will almost always cause it to split up the web. When the extreme outer corners of the cutting edges wear away too rapidly, it is evidence of too much speed. The best performance of a drill will be obtained when the effect of the work on the tool is somewhere between these two extremes.



Machining knuckle pins on a vertical spindle drilling machine—The view at the right shows the forming tool and the nature of the work it does

The remedy for properly ground drills chipping at the cutting edges is to decrease the feed and increase the speed. If a little care is taken to adjust these properly the drill will do as much work as before and have much longer life. If the correct speed is not obtained in drilling small holes with hand feed, the risk of breaking the drills is greatly increased, especially at the moment the point of the drill is breaking through the lower side of the work. This is due to the operator's difficulty in pressing lightly enough on the feeding lever not to give excessive feed to slow-running drills.

Variations in the hardness of the material drilled should, of course, be met by the skilled operator with changes in the speed and feed. This is necessary as the commercial twist drill must be tempered for average conditions so as to give good results in either hard or soft material. A drill that would give maximum results drill-

ing hard steel would be entirely too brittle to work well in softer and tougher material. To maintain the speeds and feeds recommended, it will be found necessary to use some good cutting compound. The following are recommended in the order named:

For hard and refractory steel	Turpentine, kerosene and soda water.
For soft steel and wrought iron	Lard oil, soda water.
For malleable iron	Soda water.
For brass	A flood of paraffine oil, if any.
For aluminum and soft alloys	Kerosene, soda water.
Cast iron	Should be worked dry or with a jet of compressed air for a cooling medium.

The above recommendations apply equally well to carbon or high speed drills, but it is good practice to warm the lubricant before using it with high speed tools. Any hard piece of steel is extremely brittle when cold, and high speed drills should never be put to work in that condition; they work much better when warm, often giving good results when the chips are blue. Nothing will "check" a high speed drill quicker than to turn a stream of cold water on it after it has become heated working in a hole. It is equally bad to plunge it into cold water after the point has been heated in grinding. Either of these practices

Drill jig for holding handrail columns

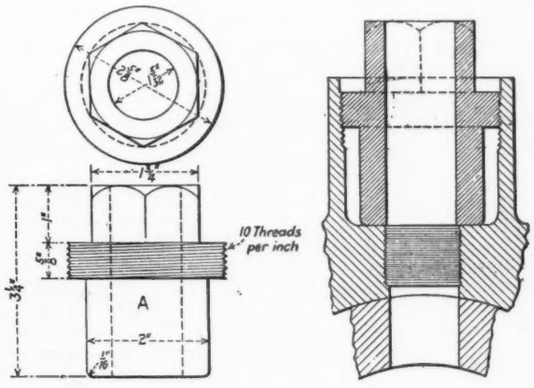
is certain to impair the strength of the drill by starting a number of small checks in it.

Grinding drills

The practice of grinding all twist drills on special grinding machines is quite general in railroad shops and it might seem that any comments on the advantages of this method are superfluous. Observations in some small shops, however, indicate that grinding by hand on ordinary stand grinders is by no means obsolete. Even in shops equipped with drill grinders mechanics often grind drills by hand to avoid making a trip to the toolroom to obtain a sharp drill. The desire to save time in this way is seldom effective. There are some skilled drill press operators who can do a very fair hand job of grinding drills, but they cannot consistently compete with the machine.

Twist drills will stand more load in proportion to their size than almost any other tool and a large percentage of drill troubles could be eliminated if proper attention were given to grinding the points. The form of the drill point controls the rate of production, accuracy of the hole, frequency of necessary grinding and the life of the drill. It has been observed that by pointing a drill properly the end pressure can be reduced about 60 per cent and the horsepower required to drive the drill by over 25 per cent.

Most twist drills are made with a gradual increase in the thickness of the web or center of the drill toward the shank. As the drill becomes shorter and the web thicker, greater force is required to drive it. To overcome this condition, it is good practice to thin the web to the original dimensions. The grinding must not extend too far up the flute of the drill and care must be exercised that the cutting lips are not injured; also that the same amount is



Jig used in drilling bushing grease plug holes

ground out of each groove. When the grinding is excessive, the web is left too thin and is liable to crumble. When this happens, a split drill is practically inevitable. Incorrect grinding is usually the cause of drills splitting up the center, and no manufacturer should be called upon to replace a split drill, unless a flaw is evident in the steel.

Twist drills are made with a slight taper from the point to the shank, so that the largest diameter is always across the corners of the cutting lips. This prevents the drills from binding in the work, when they are sharp. If the outer corners are allowed to become badly worn, the drills will bind and cannot perform satisfactorily. Whenever the outer corners of the cutting lips show wear, the drills should be reground and the worn surface completely removed, or the drills will continue to bind and very quickly be damaged beyond repair.

Suggestions for facilitating the setting-up of work

Simple jigs used with a large percentage of railway shop drilling will eliminate the necessity of laying out the work previous to drilling. For example, cotter holes in small pins may be drilled by locating the center of the hole in one pin by resting this pin in the table tee slot, bringing the work to the proper position under the drill point and clamping the table in place. The remaining pieces of work may be drilled without laying out. It will also be seen that no fixture is required here beyond using the slot in the drilling machine table.

There have been many jigs and fixtures designed in railroad shops to facilitate drill press production. The application of a few of them is shown in the illustrations. The description of a few jigs and fixtures which can be used to advantage in any railway shop will be given in the following pages.

A chuck for use on the base of a radial drill when drilling locomotive cylinder castings is shown in the drawing. The device is designed for use with piston valve cylinders and the casting is swung about the axis of the valve chamber. By revolving it about this axis, any adjustment of the cylinder may be made to provide for the drilling of all holes at right angles to the axis of the bore.

The cylinder is carried on cone centers shown at *A* and *B* in the drawing, which are mounted on the head stock *C* and the tail stock *D*, respectively. The head stock and tail stock are heavy iron castings which are mounted on cast iron bases *E*, the latter serving to raise the centers the required distance above the base of the radial drill. The tail stock is fitted with a lead screw and clamp of the same type used on lathes; the handwheel *F* operates the lead screw and serves as a means of adjusting the distance between the cones when clamping the cylinders in place.

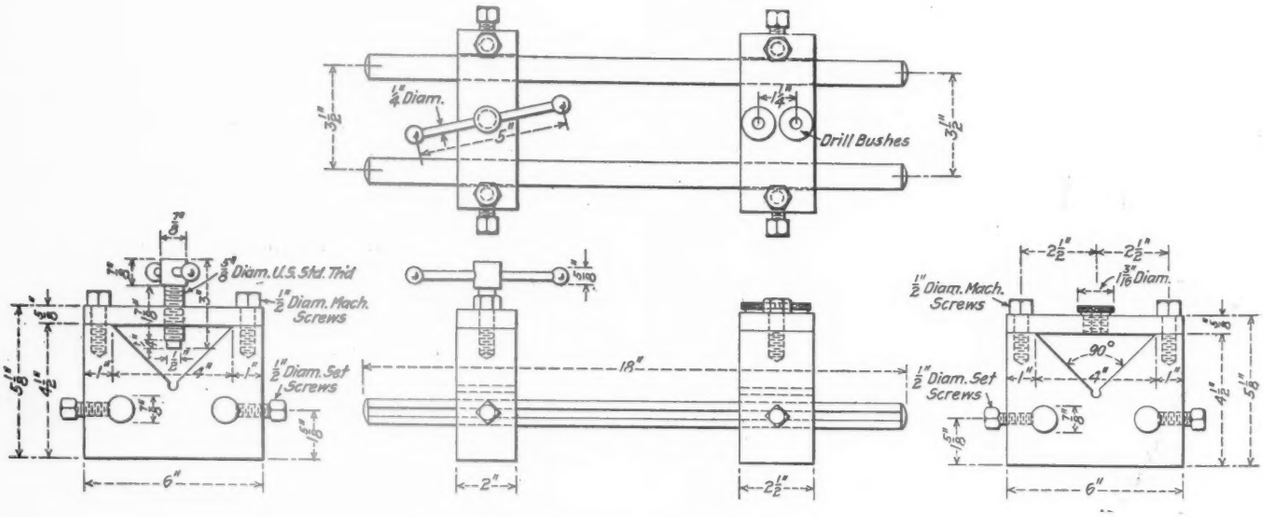
Cone *A* may be revolved about its axis in either direction by means of the handwheel *G* and a gear train. To a flange at the base of the cone is secured a driver plate which is bolted to the cylinder, causing the latter to revolve when the cone is revolved. Thus any portion of the cylinder casting may be brought into position at right angles to the drill spindle, where it is clamped by means of a ratchet and pawl device. The ratchet wheel *H* is rigidly mounted on the shaft of the operating wheel *G*. Two pawls *K*, one mounted on either side of the ratchet wheel, engage the latter and are attached to a handle *L* in such a manner than when one pawl is engaged, the other is simultaneously disengaged from the ratchet wheel. Which of the two pawls is to be used depends upon how the weight of the cylinder balances in any particular position. As the excess weight is shifted from one side of the vertical center line to the other, the position of the pawls must be changed by means of the handle *L*. The reduction gears facilitate the movement of the cylinder by hand.

By carrying the cylinder on the axis of the valve chamber bore, the weight of the casting is well balanced and comparatively small cones may be used. It is possible, however, by using large cones, to mount the casting on the axis of the cylinder and this practice is followed when slide valve cylinders are to be drilled. When used in this manner, the head and tail stocks are removed from the castings *E* and mounted directly upon the radial drill base, thus keeping the cylinder at about the same height as when swung about the center line of the valve chamber.

A handy drill jig for holding locomotive handrail columns is shown in another illustration. It is adjustable for any height of column and is arranged to drill and tap the hole in the base as well as to drill the large hole in the head for the railing pipe. As indicated in the illustration, the movable bracket is adjusted to suit the handrail column and a spanner wrench is used to tighten the hollow, threaded holding nut.

After the bushings have been pressed in side rods, it is necessary to drill holes for the grease plugs which serve two purposes: controlling the supply of grease to the bearings and preventing loose bushings from turning in the rods. The common methods of drilling these holes is to place the rod under some type of drill press and drill down through the brass bushing with a drill somewhat smaller than the smallest diameter of the grease plug threads.

There are two objections to this method in that the drill damages the threads in the rods and usually drills a hole which is off center in the rod bushing. When the attempt is made to apply a grease plug, it is often found, therefore, that the threads are damaged to such an extent



Drilling jig for drilling holes in coupler pins

that the plug cannot be turned into the rod. Moreover, the cylindrical end of the grease plug will not enter the hole in the brass bushing, and the usual procedure of the machinist is to grind down the end of the grease plug until it will fit the hole in the bushing. This results in the diameter of the plug being considerably smaller than would otherwise be necessary and should the bushing become loose in service, considerable play of the bushing in the rod may be expected.

To obviate these objectionable features, the arrangement shown in one of the illustrations has been devised. It consists of a steel jig *A*, drilled for a 1 5/32-in. hole and formed at one end in a hexagonal nut. A collar is threaded to suit the internal threads in the side rod grease cup until it strikes the bottom and it guides the drill when drilling the hole in the side rod bushing. It is apparent that this jig will not only guide the drill and prevent damaging the grease cup thread, but the hole in the rod bushing will be centrally located and no difficulty will be experienced in applying the grease plug.

One of the illustrations shows a simple jig used in railway shops to drill holes in coupler pins. A cover of the simplest design contains the guide bushings, which are

changeable to suit whatever drillings are required and which can handle a variety of such work with great rapidity. The bushing holder can be raised or covered to suit different diameters of work. Both V-blocks in which the work rests are adjustable by means of the screws for different lengths of pins and lend themselves well to a variety of work of all descriptions. It also provides a clamping device which is essential to keep the work in position while being drilled. It is simple and efficient and a characteristic example of an adjustable type of jig.

Air clamps for holding work on the table are now common tools used in most railroad shops. The air clamp shown in the drawing is small, easy to handle and uses a minimum of air. It is placed on the bed of the machine instead of on the floor.

Some unusual work handled on a drilling machine

A drilling machine can be used for reaming, boring and chamfering, in addition to drilling. The possibilities of this machine have been given much thought in various railway shops, with the result that it is now handling work which in the past has been considered only possible on other types of machine tools. Some of the illustrations show several such drilling machine operations which are used in different railway shops in this country. The eleven views on the full page of illustrations will be referred to first.

When fitting tapered bolts in such parts as main rods, eccentric crank arms, etc., it is often necessary to ream the hole so that the bolt will fit. The common method of doing this work is by means of an air motor which is slow, hard work, particularly if the hole is of any size. Photograph No. 1 shows the holes in a main rod strap being reamed complete in one hour on a Cincinnati-Bickford 6-ft. radial drilling machine located in an erecting shop.

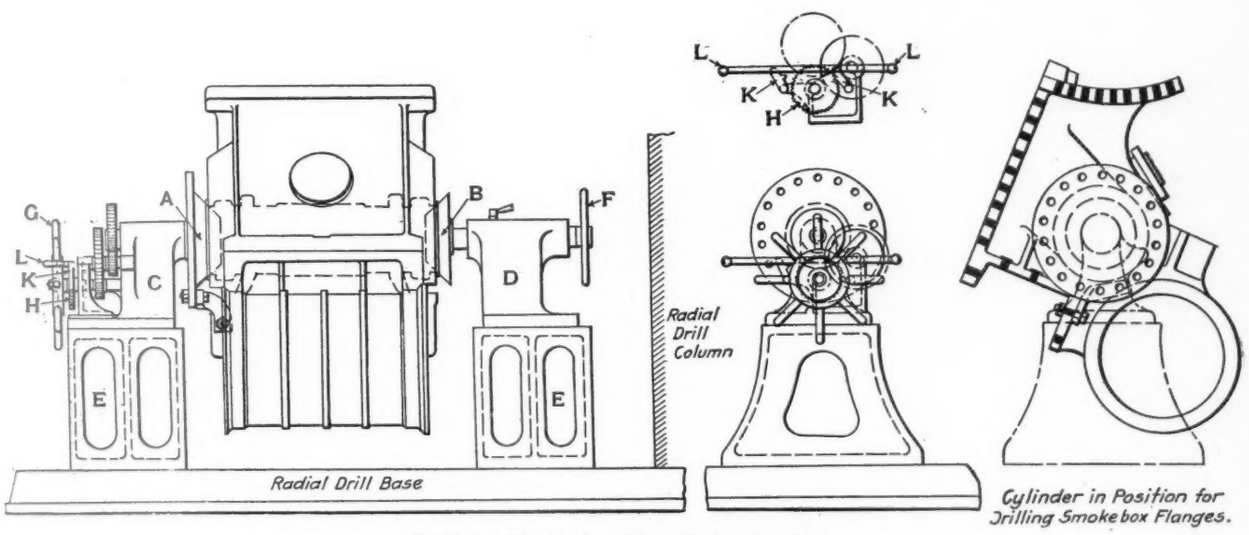
Cutting out the knuckle pin holes in a locomotive side rod can be performed to advantage on a drill press. No. 2 shows a side rod from a Consolidation locomotive set up on an American 6-ft. radial. The first operation is to drill out a 2½-in. hole, using a speed of 94 r.p.m. and a feed of .009 in. The next operation is to rough bore the hole using a 9-in. cutter at a speed of 33 r.p.m. and a feed of .007 in. This finish boring cut is made with an adjustable cutter set at 9½ in. The same speed and feed is used for this operation as for the roughing cut. The following figures show the time required for completing both ends of a side rod.

Operation	Time, min.
Setting up and changing tools	15
Drilling	25
Rough boring cut	45
Finish boring cut	45
Total time	130

The drilling machine at times is used for doing quite unusual jobs. No. 3 shows a Baker vertical drilling machine milling a 5½-in. long by 1⅛-in. wide keyway in a 4½-in. diameter piston rod. After the work is set up, an initial hole is first drilled. The reamer is then put in the spindle. The lower end of the reamer revolves a steel bushed T-block which slides along as the reamer is fed into the work. This job is completed in 21 min. using a spindle speed for the reamer of 215 r.p.m.

This job was formerly done on a regular piston rod keyway cutter which was equipped with two tools, one working from each side. The time required on this machine was 2 hr. and the work was not satisfactory, as a ridge where the two reamers met was left in the middle of the keyway.

Drilling machines are used in connection with driving box repairs. This is especially true in the case of boring and chamfering. No. 4 shows a Colburn 24-in. vertical drill press which was used to handle the overflow from the regular driving box boring machines. The driving box shown in the illustration was bored and chamfered in 40 min.



Radial drill chuck with cylinder in place

No. 5 shows a Baker vertical drilling machine which is used entirely for milling the straight and cross grease grooves in driving box shells. A jig is mounted on the table in which slots are cut to correspond to the grease grooves in the shell of the box. By an ingenious arrangement the end mill cutter follows the grooves in the gig with the result that the grease grooves can be cut in the shell in 20 min., floor to floor.

It is always desirable, when boring out the cylinders of an air compressor, not to have to take the compressor apart. This is not necessary when boring out a compressor on a radial drilling machine. View No. 6 shows a cross-compound air compressor mounted on the bed of an American 6-ft. radial drill press. All four-cylinders were rebored for new bushings, the roughing cuts requiring 4½ hr. to complete.

Besides drilling holes, the drilling machine can be used

for other work in connection with boiler shop repair work. The usual method of cutting a scarf on a flue sheet is with a pneumatic hammer. No. 7 shows a back flue sheet fastened by two bolts and one clamp bolt to the bed of a Baker single-spindle drilling machine. The flue sheet is scarfed in 6 hrs. using a 3-in. taper reamer at a speed of 103 r.p.m.

Multiple spindle machines are used in many railway shops, particularly where enough work is available to operate on a production basis. No. 8 shows a Moline six spindle drilling machine on the table of which is mounted a fixture for holding twelve valve motion pins at one set-up. Thus the six spindles are in continuous operation for as the holes are being drilled in both ends of six pins, six other pins are being placed in the fixture. In this manner 100 pins are drilled at both ends and finished complete in 8 hrs.

No. 9 shows a Foote-Burt three-spindle drilling machine on the table of which are mounted three different locomotive repair parts. At the left may be seen a driving box wedge having a 2⅝-in. wedge bolt hole drilled in it. The hourly production of these is 20. The middle view shows two spring rigging hangers in each end of each of which is drilled a 2⅛-in. hole. Twelve hangers are completed in one hour. The view at the right shows a 3 1/32-in. hole being drilled in a spring rigging bushing, ten of which are completed in an hour. It will be noticed that all the work is held by an air-operated clamp.

No. 10 shows a Niles-Bement-Pond four-spindle drilling machine drilling four holes in an arch bar, requiring only 10 min. from floor to floor.

Another interesting job of multiple spindle drilling machine work is shown in No. 11. Here may be seen a Foote-Burt six-spindle drilling machine drilling nine 1¼-in. holes in a switch frog point in 20 min.

Locomotive side rod knuckle pins can be drilled and turned on a drilling machine provided the proper tools and fixtures are available. One of the accompanying illustrations, consisting of three views, shows a Colburn single-spindle drilling machine which is used to drill and form knuckle pins. The forgings are held in place in the fixture by five set screws. The first operation, which is shown in the middle view, is to drill the hole for the collar plate bolt to pass through. Then the drill is removed from the spindle and replaced with the forming tool shown in the illustration. The work the forming tool does is shown in the view at the right of the group. This method is much quicker than turning the knuckle pins in a turret lathe.

The drilling and tapping of the holes in a new locomotive cylinder is a job which should be handled on a radial drilling machine. By the proper application of jigs this work can be greatly speeded up. The illustration, containing four views, shows a new cylinder being drilled, tapped and reamed by a Carlton 6-ft. radial drilling machine. A total of 180 holes are drilled and tapped and all necessary reaming completed in 12 hrs. The left and top center views show the steam pipe flange and saddle gages, respectively, in place.

The use of these jigs eliminates a considerable amount of the laying off work usually required. The view at the right shows the reaming of the steam pipe flange collar fit in five minutes. When the cylinder reaches the erecting shop no further drilling, tapping or reamer is required.

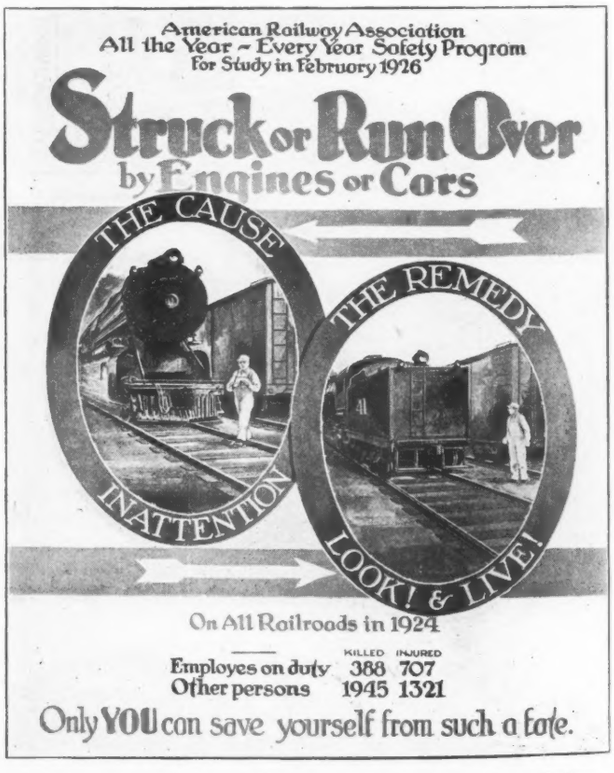
One of the views shows a Baker double-head drilling machine which is used only for boring out the brasses in locomotive driving rods. From eight to ten sets of side rod bushings are completed in eight hours.

If the proper fixture is provided, engine truck brasses, after being babbitted, can be readily bored to size on a drilling machine. The illustration, consisting of two views, shows a Foote-Burt single-spindle drilling machine on the table of which is mounted a fixture for holding engine truck, trailer and driving box brasses when boring to fit. The brass shown is a 5½-in. by 9-in. engine truck brass. The brass was completed in eight minutes from floor to floor. The depth of cut at the outside edge was ⅜ in. and at the middle 7/16 in., the cutting speed being 190 r.p.m.

Conclusion

The variety of work that can be performed on a drilling machine makes it an important tool to have in a large or small repair shop or engine terminal. A modern radial or vertical drilling machine can be used in the smaller shop not only to handle the ordinary drilling work, but to take care of boring, reaming, milling or chamfering repair work which is ordinarily handled on special duty machines. In the larger shop where greater quantities of work is handled, special duty machines are more economical, but a modern drilling machine can be used in an emergency to handle such jobs as boring driving boxes, truck brasses, reaming, etc., when the regular machine either is out of service for repairs or is unable to handle an unusual quantity of work. Furthermore, this type of machine can be economically used at times and under certain conditions as a production machine, as, for instance, in the making of knuckle pins.

In summing up the important points to be considered in the successful operation of the drilling machine, first, the machine must be considered on a par in importance with the turret lathe, milling machine, shaper, etc.; second, the operator must be properly trained to secure the maximum efficiency from the machine; third, the work should be carefully studied in order to design jigs and fixtures to increase production; fourth, all work coming into the shop should be carefully studied to determine whether or not it can be more economically machined on a drilling machine.



Educational bulletin of the American Railway Association

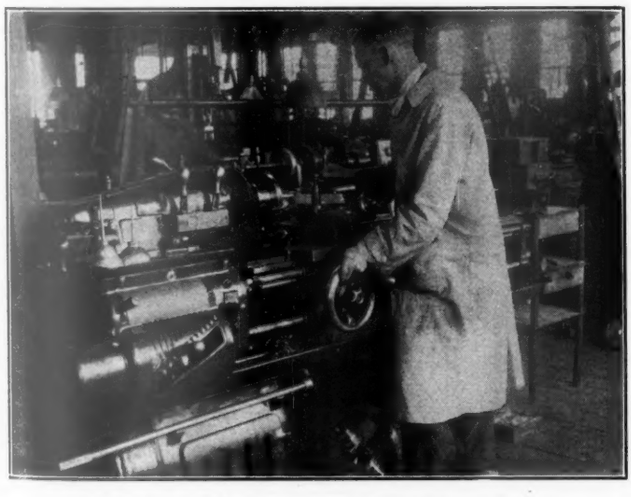
General view of system tool room at Milwaukee locomotive shops

System tool room on C. M. & St. P.

A description of how the Milwaukee has standardized tool equipment and centralized tool facilities at one shop

By O. D. Kinsey,
Tool supervisor, Chicago, Milwaukee & St. Paul, Milwaukee, Wis.

ABOUT two years ago the Chicago, Milwaukee & St. Paul started to standardize and catalog its tool equipment and lay plans for a system tool manufacturing department at Milwaukee shops in order to provide better tools and necessary labor-saving devices to reduce shop labor costs and extend the service life of the many costly appliances used on locomotives and cars.



Operator working at modern tool room lathe

Good tools are just as essential in a railroad shop as in an industrial plant and they have the same direct relation to the amount, quality and cost of work done. Many expensive appliances, such as are today used on locomotives and cars, find their way to the scrap pile long before they should on account of a failure to provide good tools for proper maintenance. We believe in giving workmen proper tools, well-designed and maintained in an efficient manner. Then the sledge hammer method can be eliminated to a great extent, saving both material and labor.

Locomotives and cars are practically standard, and similar equipment is required at each shop point, as the same maintenance problems have to be met. Therefore, to secure uniform shop practice on a railroad system it is important that the equipment be standardized and the manufacture centralized and controlled by means of a book of tool standards covering both commercial tools and equipment, as well as special tools and devices.

Standard tool folios have been made up and distributed to all supervisors and storekeepers on the C. M. & St. P. lines. This folio lists the best equipment available as gathered from our own shops and the practice on other railroads and is subject to revision as better ideas are suggested or better tools are developed.

When each shop as a railroad system has to depend on its own resources for making up small tool equipment, without having proper material, milling, grinding and heat treating facilities, as many ideas and designs will be found as there are men involved, with tool costs unreasonably high and tool efficiency low.

The Chicago, Milwaukee & St. Paul has centralized tool work at its main shops at Milwaukee, Wis., where necessary materials and machinery are now available to turn out high grade equipment at a minimum cost. Take for instance any standard special tool such as a valve seat-

ing reamer for air pumps. These reamers are now produced on a store order for stock, ready for quick delivery when called for; and advantage is taken of ma-

An effective exhaust system carries off smoke and hot gases from the furnaces

chine set-up and efficient production equipment which not only gives a better and standard tool but reduce costs.

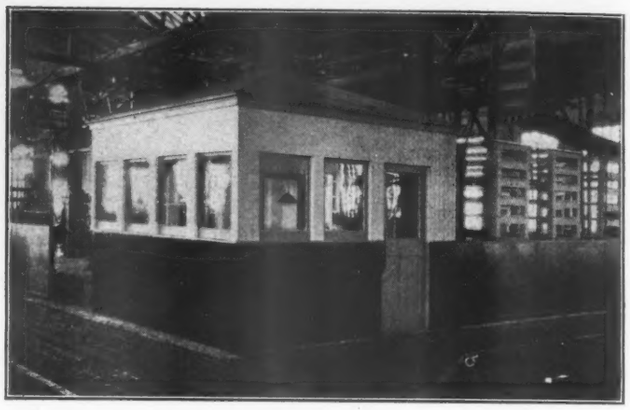
Standard commercial tools purchased

We do not contemplate the manufacture of standard commercial tools such as standard taps, drills, reamers, etc., but only special maintenance tools and labor-saving equipment. All standards for tools purchased on the open market, or manufactured in the central tool department, are controlled by the tool supervisor and a tool committee.

The central tool department has an experienced tool designer whose duty it is to study ways and means for reducing shop costs, through the development of good equipment which, when finally approved, is entered in the tool folio as standard until something better is developed.

The real value of a tool is not so much dependent upon the initial cost as upon what it will produce in work and the resultant saving in dollars and cents.

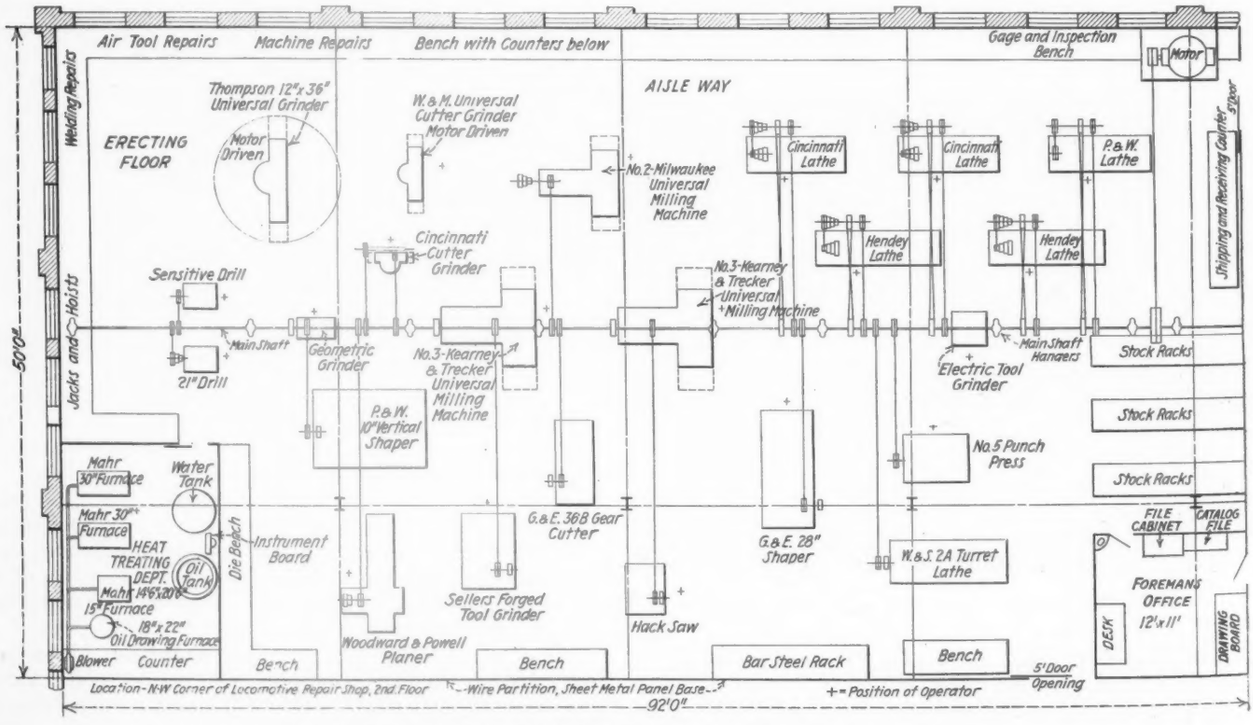
A cheap tool made of poor material, incorrectly designed or heat treated, becomes a very expensive tool when assigned to the present day workman. For instance, a common hand chisel if purchased on a price basis alone, without regard for the kind of material used or the care with which it is forged and heat treated, may cost the user several times the price of a good tool through time lost in the shop. So it is with commercial tools in gen-



Tool room office with tool racks showing at the right inside the enclosure

eral, such as taps, dies, reamers, etc., which may have a good appearance and be finely polished, but lack the essential elements of quality.

The Chicago, Milwaukee & St. Paul appreciates this fact and now purchases on specification to insure quality and efficient performance in the shop. For example, the various sizes of boiler taps have been standardized at ¾ in. taper per foot and 12 U. S. S. form thread, with



Arrangement of tools and facilities in the C., M. & St. P. tool room

standard squares and flutes and a specified face cutting angle. These taps increase in ⅛-in. steps, yet any 1/16-in. size hole may be obtained.

New and repair work for the system handled

The central tool department is for the benefit of the railroad system as a whole and both new and repair work is handled on store orders, charged out at cost and distributed through the stores department.

Grinder exhaust pipes tend to keep abrasives out of the air

The old saying, "Too many cooks spoil the broth" is literally true when applied to tool making. With our new facilities we can produce real tools in quanties at a fractional cost of that which obtained when these tools were made in small quantities at outlying points with more or less inadequate tool equipment.

Standard work moves in "tote pans" from operation to operation

The best and most modern equipment obtainable has been installed in the tool department which occupies a 50-ft. by 92-ft. space in the northwest corner of the Milwaukee locomotive shop. A wire partition divides the tool room from the rest of the shop and the tool room office in one corner of the enclosure is provided with a suitable desk, correspondence of catalog file and a draftsman's board at which tool designs can be developed.

The machinery is grouped in classified order, preference being given to the location of precision machines where the light is best. The heat treating department is located against the west wall, being in a separate wire enclosure to prevent interference with heat treating operations. Bench work is confined to the west end of the tool room, the north wall counter being used for material in process.

A routing system for all standard operations has been arranged, which moves the work in tote pans from operation to operation until it is finally inspected and placed in the stores stock.

A typical example of this method is as follows: A store order is issued for possibly three dozen standard gage cock reamers—Catalog No. T 1-1.

The tool foreman assigns this order by work slip to the screw machine operator who has a mounted blue print showing detailed construction and the operations to be performed by him as follows:

Operation 1, *Screw Machine*—Turn to blue print and allow 0.010 in. for grinding and cut off.

This operation starts the job moving. A bar of tool steel, placed in one end of the machine spindle, is quickly reduced to part No. T 1-1 and cut off on the other by duplicating movements. When three dozen pieces are run, the operator turns in a material ticket with his assignment slip, places the semi-finished job in a tote pan which is then ready for assignment to subsequent operations.

A modern gear cutting machine is part of the tool room equipment

Operation 2, *Milling Machine*—Mill flutes and square shank.

Operation 3, *Bench*—Burr and stamp tool number.

Operation 4, *Heat Treating Department*—Harden and draw.

Operation 5, *Grinding Department*—Grind and finish to print.

Operation 6, *Inspection Bench*—Inspect and O. K. to stores stock.

The shop layout drawing shows the kind of machinery installed. It will be noted that it is all modern equipment and we endeavored to balance the turning, milling, heat treating and grinding equipment to provide capacity for a steady flow of work in process. We believe we have worked out an efficient arrangement in this regard.

Practically all work in process, also raw materials, are carried in stores account, excepting direct repair work required by the local shops which is charged to Account 302.

All requisitions covering both purchased and manufactured tools are checked, corrected and approved by the tool supervisor before going to the purchasing agent.

Machine shop erecting bay served by 250-ton crane

A. T. & S. F. San Bernardino locomotive shops

Stripping pits and 21 pits for heavy boiler and tender work in boiler shop—30 pits in erecting shop

THE San Bernardino, Cal., locomotive shops of the Atchison, Topeka & Santa Fe constitute one of the largest locomotive repair plants in the country and, together with the car department, occupy a site of about 66 acres opposite the San Bernardino passenger station. The buildings are mostly new; however, some parts of the old buildings were utilized by additions or by removing and rebuilding. In general the new repair facilities comprise a machine shop, boiler shop, blacksmith shop, pipe, tin and welding shop, and flue shop. All these buildings are of steel framing with walls of brick or concrete. Liberal use is made of steel sash both for light and ventilation. The floors of the machine shop and boiler shop are all of wood blocks laid on concrete, and the roofs are of laminated wood construction covered with fireproof roofing so that the entire shops are fireproof and also well lighted and ventilated.

The machine shop and boiler shop each face a transfer table 65 ft. in length which handles locomotives and material between the two shops. There are 30 pits in the machine shop and 29 pits in the boiler shop. The machine shop is 673 ft. in length and 201 ft. in width and is comprised of three bays—an erecting bay 90 ft. in width, a light machine bay of 46 ft., and a heavy machine bay 65 ft. in width. Over the erecting bay operates a 250-ton electric traveling crane with 15-ton high speed hoists, while on a runway below this crane are two 15-ton cranes. Over the heavy machine bay are two 15-ton cranes supplemented by another 15-ton crane over the wheel storage outside of the building which is at right angles to the machine bay. Outside of the machine shop building is a material platform 43 ft. in width over which operates a crane also of 15-ton capacity.

The boiler shop is of the same length as the machine shop (673 ft.), and is 164 ft. in width. There are two bays in the boiler shop, an erecting bay 90 ft. in width and the machine bay 74 ft. in width. The electric traveling crane which operates over the erecting bay is of 175-tons capacity with auxiliary hooks of 15-tons capacity, while over a portion of the machine bay operates a crane with a capacity of 15-tons.

The blacksmith shop building and the pipe and tin shop building are located between the machine shop and the roundhouse. The former is 306 ft. in length by 80 ft. in width, while the latter is 213 ft. in length by 67 ft. in width.

The flue shop is in a separate building 108 ft. in length by 45 ft. in width and situated outside of the boiler shop.

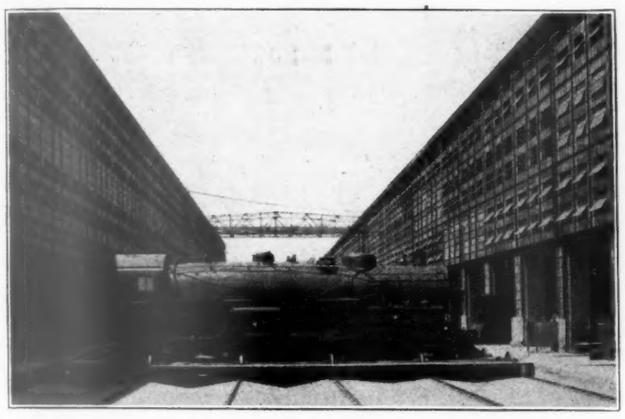
Other new buildings included in this improvement consist of the power house 103 ft. long by 81 ft. wide, also of steel framing with concrete walls, and a sheet metal storage building 193 ft. by 101 ft., paint and grease shop, office, apprentice school building, fire hall, and assembly hall, together with lavatory facilities.

The store department building is being enlarged by an addition of three stories 275 feet in length, and also an extension of 500 ft. is being made to the material platform which will make the storehouse building altogether 50 ft. in width and 600 ft. in length, and the material platforms of the same width by 1,450 ft. in length.

Locomotives are handled into the repair shops on the transfer table 120 ft. in length which operates back of

the boiler shop. This length of table is employed so that it will accommodate the largest locomotives with tender as well as the shop shifting engine. The locomotive is set on the stripping pits, Nos. 24, 25 and 27 of the boiler shop, while the tender is shifted to one of the storage tracks back of the boiler and tender shop.

Since all engines in the territory served by this shop burn fuel oil the work on oil tanks and tenders is an important factor. On these tender storage tracks facilities



Transfer table between the machine and boiler shops with a heavy Mountain type locomotive on the table

are provided for draining the oil from the tender oil tanks and running it into a storage where it is pumped to fill the oil tanks of engines going out of the shops. These facilities also steam out the oil tanks and prepare them for the shop. The oil carried out by the steaming process is reclaimed by means of a separator and conveyed to the fuel oil storage.

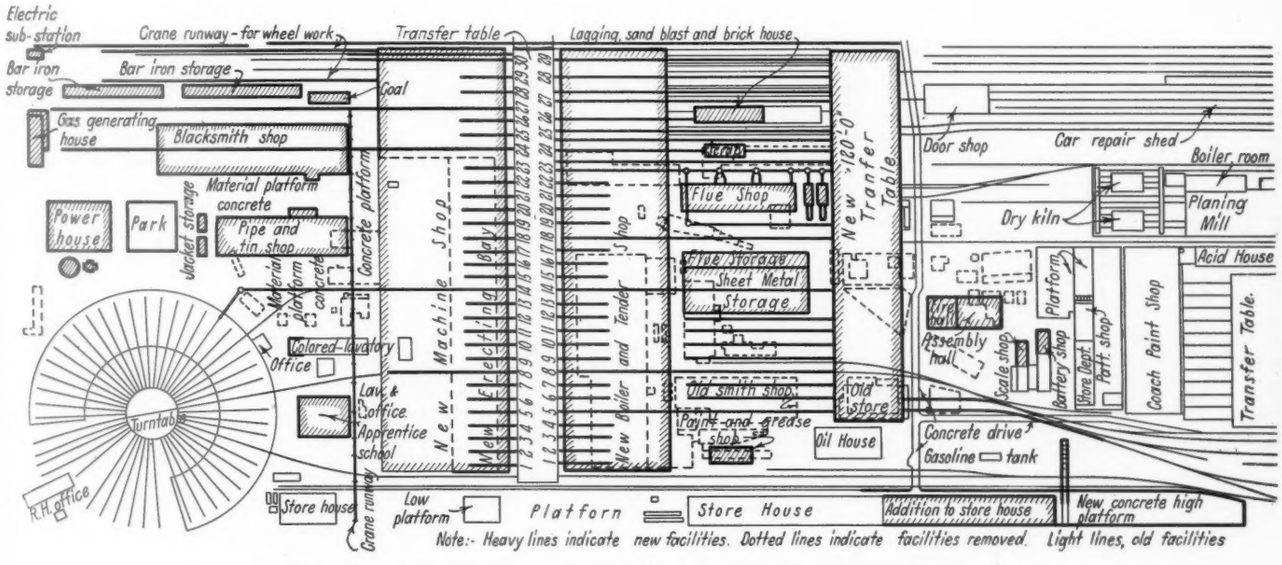
A rather novel arrangement is employed at the stripping pits, in that the lye vats are located inside of the building so that the traveling cranes which remove parts from locomotives can afterwards place these parts directly into the lye vats. There are four lye vats each 20 ft. by 10 ft. by 4 ft. 6 in. deep. In addition to the traveling crane each vat is also supplied with a jib crane with a geared air hoist of 2-ton capacity. When the parts have been cleaned they are delivered across the transfer table by storage battery or gasoline driven shop trucks to the machine shop or material platform outside of the machine shop. If boiler repairs are required the 175-ton crane conveys the engine directly to a pit in the boiler shop.

Machine work

The wheel and driving box work is done at the north end of the machine shop. This work is very heavy as the locomotives served by this shop operate on mountainous and considerable desert territory, and as a result the tires require turning frequently and the sand and grit collecting in the bearings necessitate a great deal of driving box and journal work. It is customary to send locomotives into this shop from a number of points on the Coast Lines for this class of work as it has been found much more convenient and economical to handle the engines with the cranes and equipment in this shop than with the drop pits in the roundhouse.

For the driving wheel work itself the shop is equipped with two 90-in. driving wheel lathes, one journal truing lathe, a 52-in. car wheel turning lathe for trailer and truck wheels, and in addition, two quartering machines together with boring mills, axle lathes, etc., as shown in the detailed list included in this article. These machines are served by the crane in the heavy machine bay as well as by jib cranes with geared air hoists. Outside of the machine shop and adjacent to the driving wheel gang is an ample wheel storage. This storage is at right angles to the main shop and is 40 ft. wide and 440 ft. long, and is under the 15-ton electric traveling crane. Here are not only the wheels for engines in the shop, but also storage of new tires, wheel centers, etc. At the end of the storage space nearest the shop, room is made for tire dismounting and mounting work, and counterbalancing of wheels. This work is protected by a canopy. The tires for mounting are heated in an 8-ft. by 16-ft. car bottom furnace, the temperature being controlled by a pyrometer. This furnace is large enough to contain at one time a whole set of tires, and is also available for annealing locomotive parts. The work on locomotive trucks is done near the driving wheel gang using the same machinery. The trucks are assembled over a pit in the machine bay.

The driving box gang is adjacent to the wheel gang and



Plan of the new Santa Fe Coast Lines shops at San Bernardino, Cal.

on account of the large amount of work required, this gang is amply supplied with machine tools, including a 100-ton press of the latest type, three boring mills, one of them especially fitted for boring driving boxes, and four draw cut shapers, together with the other machinery. The facing of shoe and wedge faces of driving boxes and finishing for the brass fit as well as the fit of the brass shell into the box is all done on the draw cut shapers. These shapers also do some work on brasses for the rod gang.

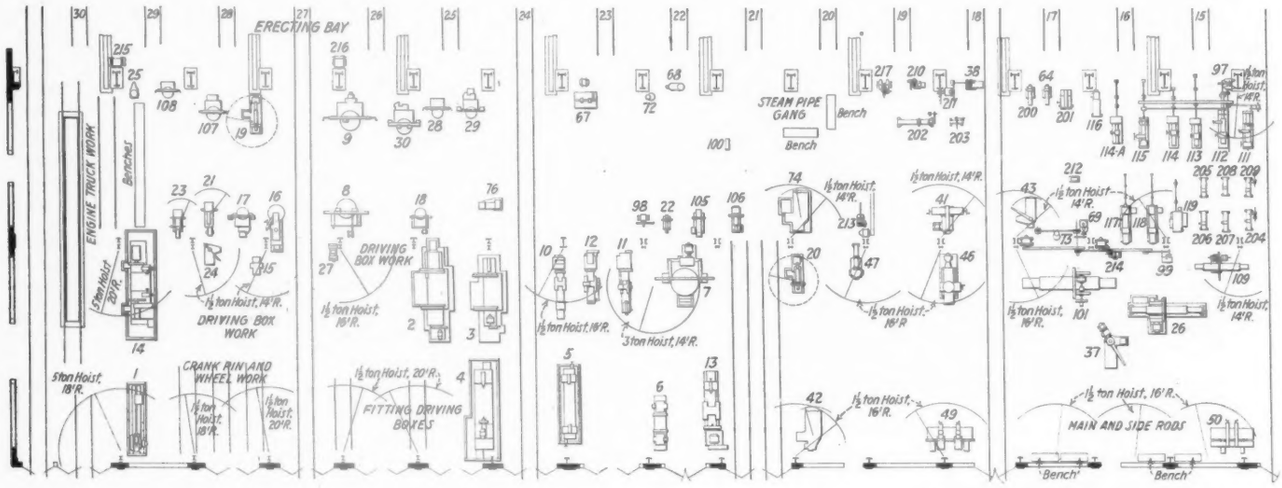
The guide and piston gang is located in the heavy machine bay, and machine equipment for this gang includes a piston rod grinding machine, and a guide grinder of the modern types, as well as other machine tools as shown in the attached list.

The main and side rod gang are also in the heavy machine bay with the machines most needed near at hand, including a large two-spindle drill press, two heavy duty upright drill presses, two slotters, two radial drills, and three milling machines. The rods are put on "horses" and at right angles to the axis of the shop, placing the end of the rod to be worked nearest the bench and the bench against the wall, which arrangement gives excellent lighting for the work. Seven jib cranes with 16-ft. booms and 1½-ton geared air hoists pivoted on the steel supporting the building against the wall serve the rod gang throughout. These transfer the rods on the "horse" and also to the drill presses.

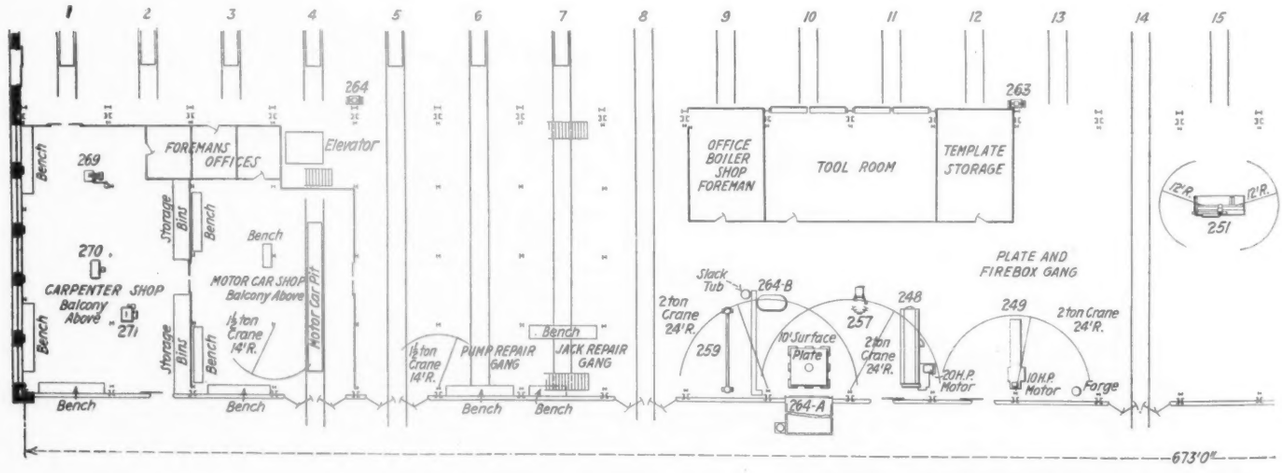
The valve and valve motion work is handled near the south end of the shop and the machines in this gang include two horizontal boring and drilling machines, two milling machines, a 6-ft. radial drill, two slotters, a small draw cut shaper, and a link grinder of the modern type.

Not all of the machine tools serving each gang are placed within the gang, as there is a large group of miscellaneous machines, especially planers, lathes and drill presses, which are near these gangs and available for all of them. These machines are located mostly in the light machine bay, but there are also a number of lathes and other machines located in the heavy machine bay. Practically all of the machinery in the heavy machine bay is individual motor driven and of modern heavy duty types. There are a few of the old belt driven lathes which are run with motors and countershafts carried on brackets suspended from the building steel and carried out into the heavy machine bay for a distance of about 6 ft.

The brass, bolt, and stud work is done on a group of turret and screw machines and engine lathes, and located in the light machine bay. Most of the fitted bolts are turned by the lathes in this group, however, and there is a portable 14-in. by 6 ft. engine lathe which is used for fitting bolts on the erecting floor. The erecting floor is



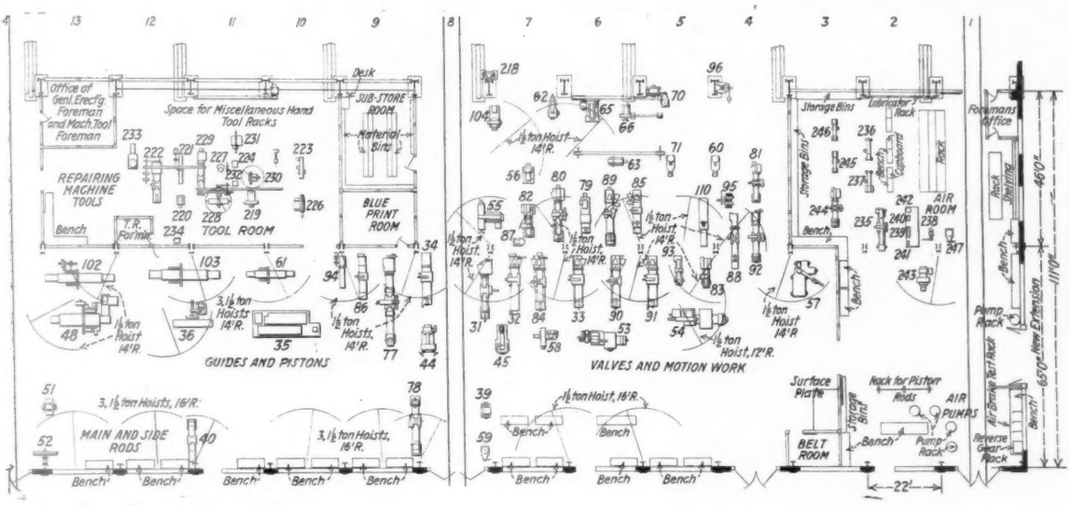
Arrangement of the machine bays



Layout of the boiler machine shop, showing

also provided with six portable electric welding machines, and four double grinders conveniently placed.

The pits in the erecting floor are all piped and have connections for water, steam, air, acetylene and oxygen gas. Electric drop cord receptacles are also provided, so that the trucking aisles on the floor are reasonably free from hose and electric cords. The pipe mains are all carried overhead with drops carried down the columns and under



at the San Bernardino shops

the floor through a shallow trench into the pits, thus making all the piping easily inspected and maintained.

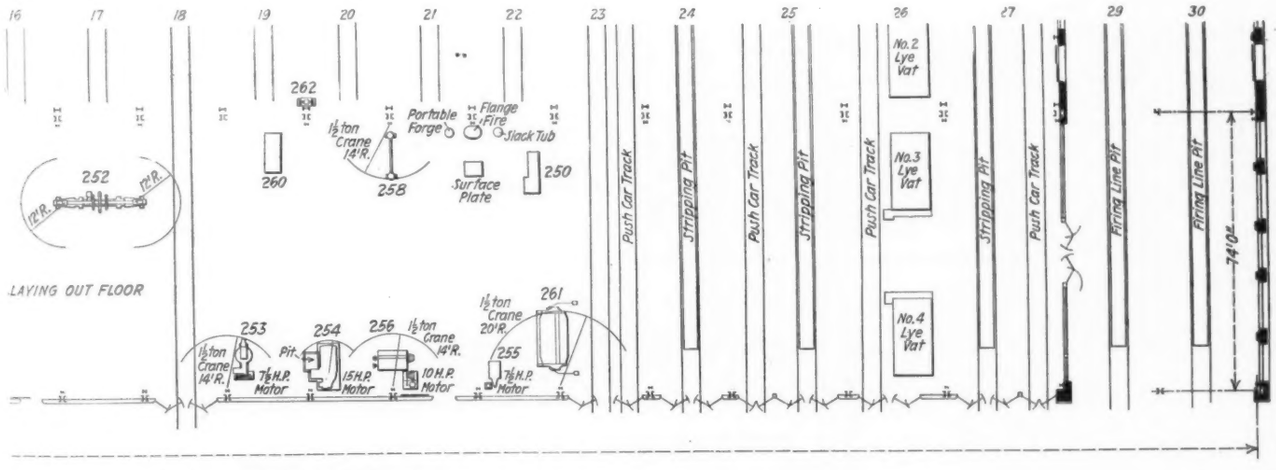
The tool room is located in the center of the shop where the tool foreman can give his attention to the machine work as well as to the distribution of hand tools. The racks for hand tools issued to workmen are convenient both to the erecting floor and the machine shop. Machine tools shipped in from Coast Line shops are repaired in the tool room and these are handled by the traveling crane in the heavy machine bay to a position in front of the tool room. No extensive manufacturing is undertaken in this tool room and the machinery is mainly for repairs to machine tools and certain parts of railway equipment usually handled in the tool room.

The air room is located in the extreme south end of the machine shop and extends from the light machine bay through into the heavy machine bay so that the pumps and reversing gear cylinders and mechanisms (which are also repaired in the air room), can be handled by the traveling crane. The air room is provided with all machine tools necessary to carry on the work. Also, the air room has its own lye vat on the material platform outside so that all the work of air equipment is under the supervision of the air room foreman. As is customary the tool room and air room are enclosed by metal and wire partitions.

In the center of the machine shop is located an office for the erecting foreman and general machine foreman. Adjacent to the tool room is a substore room for small supplies, and also a blue print room. All blue prints are mounted on card board and varnished, and are kept in racks in this room under the care of an attendant who sees that the prints are properly indexed and kept up to date.

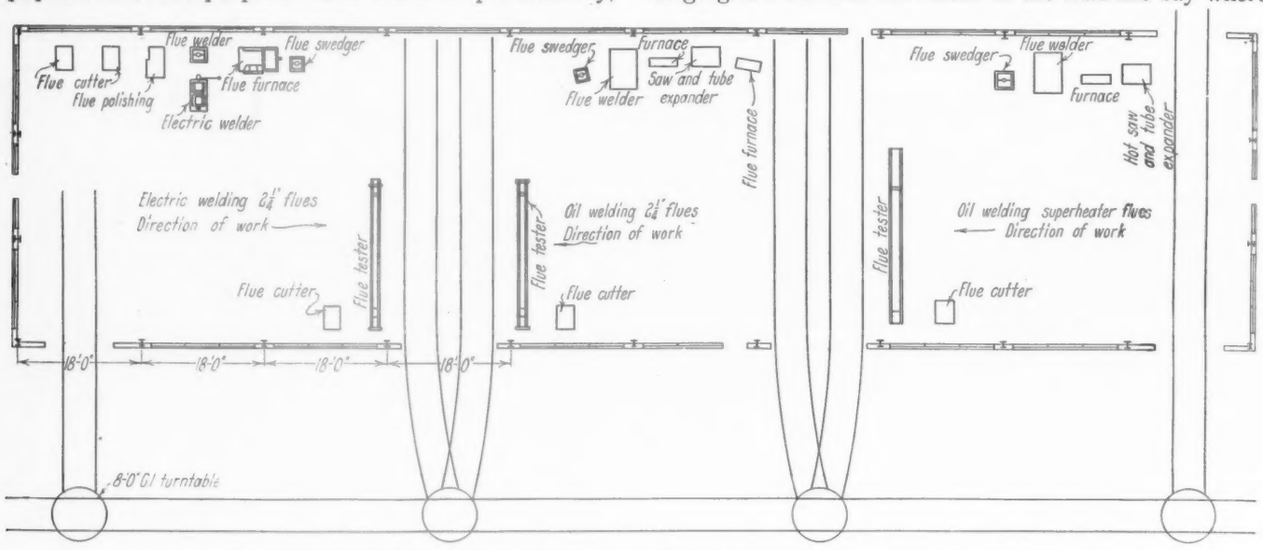
Boiler shop and tender shop

As before stated, the boiler shop resembles the machine shop in general appearance and is of the same length, but has only one machine bay in addition to the erecting bay. This machine bay is 74 ft. wide and most of the steel comprising it was taken from the erecting bay of the old machine shop. It is served by an electric traveling crane of 15-tons capacity. The erecting bay is 90 ft. wide and is served by a crane of 175-tons capacity with 15-ton high speed auxiliary hooks. The stripping pits are in one end of this building as previously mentioned.



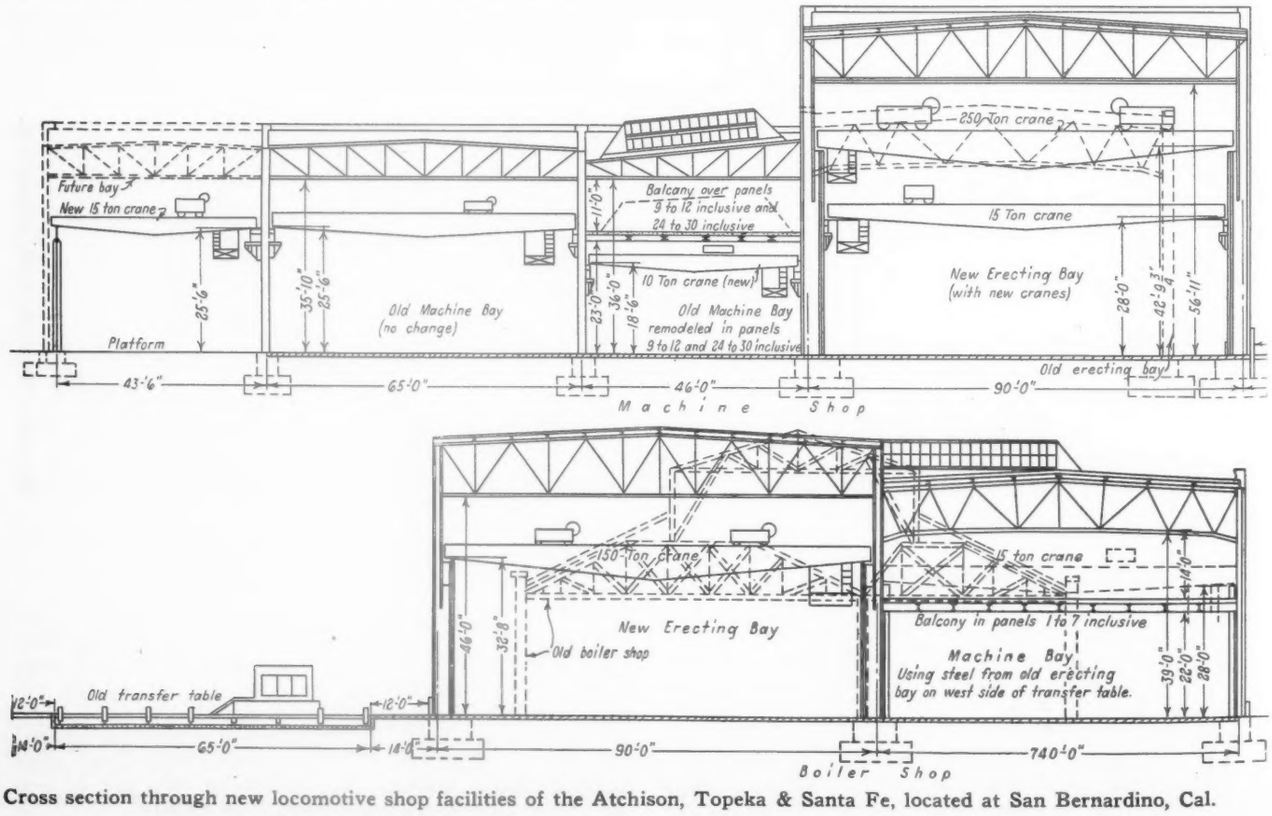
parts of the stripping and firing-up tracks

The boiler shop is equipped for handling all the boiler work, and especially flue work, the latter being particularly heavy on account of the bad water district through which the Coast Lines engines operate. The shop, however, does not attempt to build complete back ends with fire boxes as these are usually made on shop order in the Topeka shop, which has hydraulic bull riveters and other equipment for this purpose. The boiler shop machinery, pneumatic cold flanging machine, drill presses, and other machinery as shown by the list. The work on locomotive boilers is performed on an erecting floor from panels Nos. 9 to 22, inclusive, while the work on tenders and oil tanks is handled on the erecting floor on panels Nos. 1 to 7, inclusive. The tenders are handled into the shop on track No. 8 from the tender storage outside the shop. The flanging is done near the center of the machine bay where



Layout of machinery and tracks in new flue shop, constructed in three units

however, comprises three bending rolls, a 40-in. double end punch and shear with shearing blades for flat and round bars as well as angles and other steel shapes used in locomotive tenders. There are also two flanging clamps, an angle bending roll, a cornice brake with capacity up to ⅜ in. two pneumatic flanging clamps, a the clamps and surface plate are placed on a concrete block 31 ft. in width by 63 ft. in length. The plate furnace measuring 10 ft. by 14 ft. is outside of the building and so arranged that the plates are taken out of the furnace into the building through the wall, in this manner keeping the heat from the furnace outside of the building. Elec-



Cross section through new locomotive shop facilities of the Atchison, Topeka & Santa Fe, located at San Bernardino, Cal.

tric pyrometers are provided to regulate the heat in this furnace.

All the machinery in the machine bay is individual motor driven. In the center of the machine bay is the office of the foremen, also tool room for workmen's hand tools, and in addition a room is provided for boiler template storage. In the extreme south end of the machine bay is

Flue rattler building and end of the flue shop building

located a carpenter shop equipped with a single surfacer, band saw, combination rip and cut-off saw with mortiser attachment for wood working in connection with the locomotives and tenders and also the motor car shop which adjoins it. The motor car shop handles repairs to motor driven hand cars and similar motor driven equipment. Adjacent to the motor car shop are three tracks in the machine bay set aside for repairs to tender trucks, which are run into the machine bay from the erecting bay.

There is a balcony over the carpenter shop, motor car shop, and truck shop extended 7 panels from the south end, and in this balcony are lavatories for the boiler shop men, also a shop for repairs to motors and other electrical equipment, including headlight generators. The material is handled to the balcony by means of an elevator.

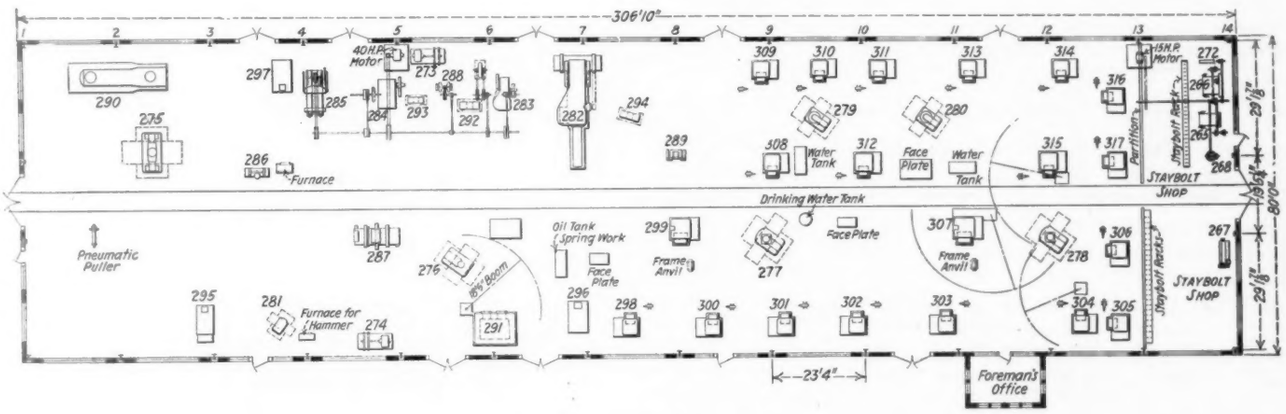
After the engines have been wheeled in the machine shop they are brought to two pits at the north end of the boiler shop known as the firing-up pits. Here the engines are connected to their tenders and fired up. These pits are separated from the main part of the boiler shop by a partition of glass sash and the side walls are omitted. Monitors are provided which allow free circulation of air. The 15-ton crane operating over the machine bay runs out of the end of the boiler shop building and serves the firing up pits. A swinging door is provided in the boiler shop end wall for this purpose.

Flue shop

The flue work is done in a separate building outside of the main boiler shop, the flues being handled by push cars to the rattlers, of which there are two, both of the Baird dry type. These rattlers are enclosed in a building

Firing-up pits at the north end of the boiler shop

with sound insulated walls to lessen the noise. There are three sets of flue machinery, two for 2¼-in. tubes, of which one set is arranged for electric welding and the other for oil fired furnace welding. The third set of machines is for superheater flues and has oil fired furnaces.



The blacksmith shop layout

The safe ends are cut by an automatic safe end cutting machine. The flue testers and cutters are the railroad company's make, as are also the flue rollers and flue grinders in connection with the electric welding outfit.

Steel plate storage

Boiler plates and flues are stored under cover in a building adjacent to the boiler shop. In this building the boiler plates are set on edge between rail supports and

are handled by an electric traveling crane of 7½-tons capacity having a span of 74 ft.

Blacksmith shop

The blacksmith shop has equipment both for heavy and light forging work. This shop handles not only the locomotive department, but the car department, as well as some shop order work for points on the line. In the way of steam hammers it has one 4,000-lb. double frame ham-

Tools and facilities in the San Bernardino Locomotive Shops

(Reference numbers refer to drawings)

WHEEL REPAIR GANG

Tool reference number

1—1 600-ton wheel press
2 and 3—2 90-in. driving wheel lathes
4—1 journal truing lathe
5 and 6—2 quartering machines
7—1 96-in. boring mill
8—1 84-in. boring mill
9—1 72-in. boring mill
10—1 36-in. x 18-ft axle lathe
11—1 48-in. x 16-ft. engine lathe
12—1 36-in. x 12-ft. engine lathe
13—1 54-in. x 14-ft. engine lathe
14—1 52-in. car wheel turning lathe
18-ft. x 16-ft. car bottom tire heating and annealing furnace
1 counterbalance rock

DRIVING BOX GANG—MACHINERY

15—1 100-ton driving box press
16—1 54-in. boring mill
17 and 18—2 42-in. boring mills
19—1 36-in. pillar shaper special for driving box work
20—1 36-in. special railway draw cut shaper
21—1 36-in. draw cut shapers
22—1 23-in. draw cut shaper
23—1 32-in. draw cut shaper
24—1 60-in. radial drill
25—1 24-in. upright drill
26—1 36-in. x 36-in. x 12-ft. planer
27—1 3-in. x 24-in. double grinder

GUIDES, PISTON AND CYLINDER BUSHINGS

28 and 29—2 42-in. boring mills
30—1 54-in. boring mill
31 and 32—2 36-in. x 16-ft. engine lathes
33 and 34—2 32-in. x 15-ft. engine lathes
35—1 piston rod grinder
36—1 48-in. heavy duty face (guide) grinder
37—1 6-ft. radial drill press
38—1 nut facer
39—1 3-in. x 24-in. double dry grinder

MAIN AND SIDE ROD GANG MACHINERY

40—1 24-in. x 12-ft. engine lathe
41—1 heavy duty milling machine
42—1 6-ft. radial drill press
43—1 5-ft. radial drill press
44 and 45—2 high duty upright drill presses
46—1 20-in.—24-in. slotter
47—1 15-in. slotter
48—1 slot milling machine
49 and 50—2 two-spindle drilling machines
51—1 bushing press
52—1 surface grinder

VALVE AND LINK MOTION GANG

53 and 54—2 horizontal drilling and boring machines
55—1 high duty vertical milling machine

Tool reference number

56—1 high duty vertical milling machine
57—1 6-ft. radial drill press
58—1 link grinder
59—1 24-in. upright drill press
60—1 26-in. upright drill press
61—1 30-in. x 12-in. planer
62—1 12-in. slotter
63—1 24-in. draw cut shaper

MISCELLANEOUS MACHINES, NOT ASSIGNED TO SPECIAL GANGS, AVAILABLE FOR ALL WORK

64—1 1½-in. rod and bolt cutter
65—1 high duty miller
66—1 1½-in. vertical miller
67—1 two-spindle drill press
68, 69 and 70—3 24-in. upright drill presses
71—1 26-in. upright drill press
72 and 73—2 13-in. sensitive drill presses
74—1 6-ft. radial drill press
76—1 10-in. cold saw
77—1 30-in. x 24-ft. engine lathe
78—1 26-in. x 16-ft. engine lathe
79—1 25-in. x 14-ft. engine lathe
80—1 24-in. x 12-ft. engine lathe
81—1 20-in. x 10-in. engine lathe
82—1 25-in. x 10-in. chucking lathe
83—1 21-in. x 8-ft. chucking lathe
84—1 36-in. x 16-in. engine lathe
85—1 32-in. x 12-ft. engine lathe
86—1 26-in. x 12-ft. engine lathe
87—1 single dry grinder
88—1 24-in. x 16-ft. engine lathe
89—1 24-in. x 16-ft. engine lathe
90 and 91—2 32-in. x 15-ft. engine lathe
92—1 24-in. x 14-ft. engine lathe
93—1 20-in. x 8-ft. engine lathe
94—1 18-in. x 8-ft. engine lathe
95 to 98, incl.—4 3-in. x 24-in. double dry grinder
99—1 universal tool grinder
100—1 48-in. grind stone
101—60-in. x 16-ft. planer
102—36-in. x 12-ft. planer
103—30-in. x 8-ft. planer
104—1 14-in. slotter
105—1 32-in. crank shaper
106—1 30-in.—32-in. draw cut shaper
107—1 50-in. boring mill
108—1 37-in. boring mill
109—1 horizontal miller
110—1 horizontal boring machine

BRASS AND BOLT GANG

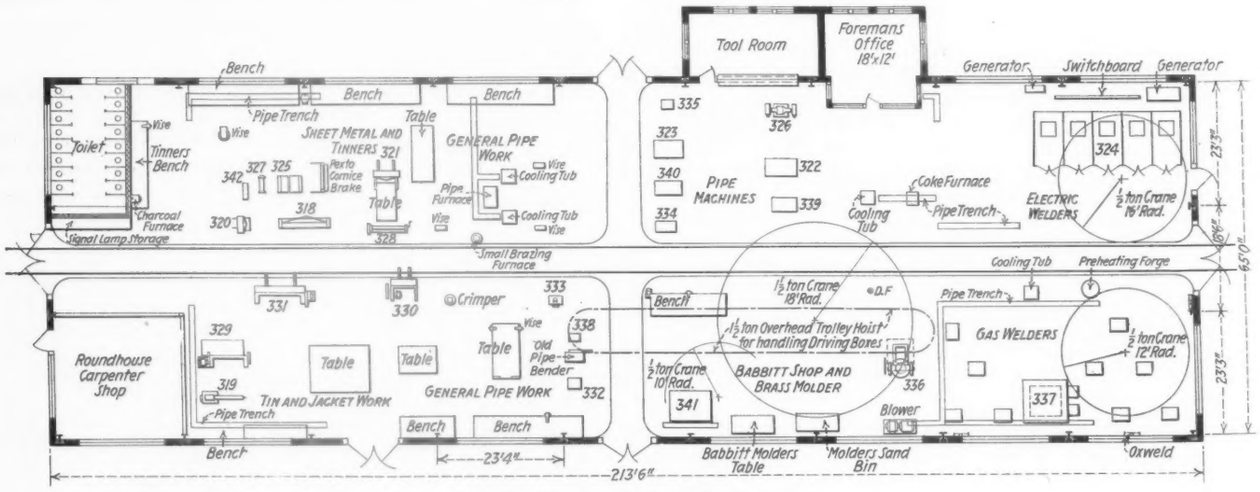
111—1 6½-in. x 24-in. turret lathe
112—1 3½-in. x 24-in. turret lathe
113—1 3-in. x 36-in. turret lathe
114—1 2¼-in. x 36-in. turret lathe
114-A—1 2½-in. x 36-in. turret lathe
115—1 2¼-in. x 24-in. turret lathe
116—1 2-in. x 24-in. turret lathe
117 and 118—2 No. 3 flat turret lathes
119—1 2-in. automatic screw machine
200—1 1½-in. single head bolt cutter
201—1 2-in. double head bolt cutter
202 and 203—2 bolt centering machines
204 and 205—2 6-in. x 16-in. bolt lathes
206 to 209, incl.—4 5-in. x 16-in. bolt lathes
210 and 211—2 nut facers
212—1 16-in. power hack saw
213 and 214—2 single dry grinders

ERECTING BAY

215 to 218, incl.—4 3-in. x 24-in. double dry grinders
6 portable electric welding machines
1 14-in. x 6-ft. portable engine lathe

TOOL ROOM

219—1 No. 3 universal belt driven milling machine
220—1 No. 2 universal belt driven milling machine



The pipe, tin and welding shop

Tool reference number

221—1 18-in. x 8-ft. belt driven engine lathe
222—1 20-in. x 10-ft. belt driven engine lathe
223—1 No. 2 belt driven universal grinding machine
224—1 ⅜-in. x 16-in. belt driven die grinder
225—1 2-in. x 14-ft. double dry belt driven tool grinder
226—1 12-in. x 36-in. belt driven universal grinder
227—1 14-ft. sensitive drill press, belt driven
228—1 No. 4-A belt driven milling machine
229—1 24-in. x 16-ft. motor driven engine lathe
230—1 No. 14, belt driven universal grinder
231—1 3½-in. belt driven drill grinder
232—1 20-in. double motor driven tool grinder
233—1 32-in. motor driven drill press
234—1 hydraulic hand press

AIR ROOM

235—1 21-in. x 10-ft. belt driven engine lathe
236—1 16-in. x 6-ft. belt driven brass lathe
237—1 18-in. x 6-ft. belt driven brass lathe
238—1 14-in. sensitive drill press, belt driven
239—1 9-in. x 3-ft. 6-in. belt driven bench lathe
240—1 valve grinding lathe, belt driven
241—1 1½-in. x 10-in. double bench grinder, belt driven
242—1 1½-in. x 10-in. grinder and buffer, belt driven
243—1 motor driven cylinder grinding machine
244—1 20-in. x 10-ft. motor driven engine lathe
245 and 246—2 18½-in. x 6-ft. motor driven brass lathes
247—1 24-in. motor driven upright drill press

BOILER SHOP

248—1 20-ft. bending roll
249—1 10-ft. bending roll
250—1 5-ft. 6-in. hand power bending roll
251—1 48-in. combination universal double end punch and shear
252—1 1⅛-in. x 60-in. double end punch and shear
253—1 horizontal flange punch
254—1 6-ft. radial drill press
255—1 42-in. upright drill press
256—1 two-spindle drill press
257—1 pneumatic cold flanging machine
258—1 10-ft. pneumatic flanging clamp
259—1 20-ft. pneumatic flanging clamp
260—1 ½-in. x 4-in. by 4-in. angle iron bending roll
261—1 ⅜-in. x 12-ft. cornice brake
262 to 264—3 3-in. x 24-in. double dry grinders
264-A—1 12-ft. x 12-ft. oil burning plate furnace
264-B—1 oil burning flange furnace
265—1 2-in. double head bolt cutter
266—1 1½-in. double head bolt cutter
267—1 four-spindle staybolt cutter
268—1 five-spindle staybolt drilling machine
269—1 38-in. band saw
270—1 single surfacer
271—1 universal saw bench
272—1 staybolt nicking machine
6 portable rivet heaters

See blacksmith shop drawing for staybolt department machinery.

BLACKSMITH SHOP

273 and 274—2 motor driven air blowers
275—1 4,000-lb. steam hammer
276—1 2,000-lb. steam hammer
277 to 279—3 1,500-lb steam hammers
280—1 1,100-lb. steam hammer
281—1 250-lb. steam hammer
282—1 4-in. forging machine
283 and 284—2 2½-in. forging machines
285—1 20-in. bulldozer
286—1 18-in. air bulldozer
287—1 double end large punch and shear
288 and 289—2 3-in. x 24-in. double grinders
290 and 291—2 5-in. x 7-ft. 6-in. oil burning furnaces for steam hammers
292 and 293—2 bolt forging furnaces
295—1 case hardening furnace
296—Spring furnace
297—bulldozer furnace
298 to 317, incl.—20 coal forges

PIPE AND TIN SHOP

318—1 8-in. hand power cornice brake
319—1 24-in. rotary shear
320—1 30-in. foot power shear
321—1 42-in. foot power shear
322—1 8-in. pipe threading and cutting machine
323—1 2-in. pipe threading and cutting machine
324—1 four-man electric welding machine
325—1 42-in. hand power bracket and folder
326—1 3-in. x 24-in. double dry grinder, motor driven
327—1 1¼-in. x 30-in. slip roll forming machine, hand power
328—1 4-in. x 42-in. slip roll forming machine, hand power
329—1 5/32-in. multiple punch, motor driven
330—1 42-in. motor driven shear
331—1 8-ft. motor driven shear
332—1 1-in. and 2-in. hand power pipe bender
333—1 1½-in. to 4-in. hydraulic pipe bender
334—1 6-in. pipe cutting machine motor driven
335—1 motor driven drill press
336—1 42-in. brass melting furnace complete with blower
337—1 12-ft. x 12-ft annealing furnace for welding department
338—1 hand punch
339—1 2-in. pipe threading machine
340—1 1½-in. pipe threading machine
341—1 babbitt furnace
342—1 small hand circle shear

FLUE SHOP

Electric Welding—2¼-in. tubes
2 motor driven flue cutting machines
1 Belt flue polishing machine, motor driven
1 double dry motor driven grinder
1 flue welding furnace for small flues
1 pneumatic flue swedger
1 flue testing machine combined with
1 motor driven flue cutting machine

Oil Welding—2¼-in. tubes
2 Flue welding furnaces for small flues
1 3-in. motor driven hot saw
1 flue roller welding machine, motor driven
1 pneumatic flue swedger
1 testing machine combined with
1 motor driven flue cutting machine

Oil Welding—5½-in. Superheater Flues
2 flue welding furnaces for superheater flues
1 flue roller welding machine, motor driven
1 McGrath pneumatic flue swedger
1 testing machine combined with
1 motor driven flue cutting machine
1 Automatic safe end cutting machine, motor driven
2 motor driven dry drum rattlers

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mer and several single frame hammers, one of 2,000 lb. capacity, and four of 15,000-lb. capacity, and in addition several smaller hammers. The shop is equipped with one 4-in. forging machine and two 2½-in. forging machines together with two bulldozers. All the hammer and bolt furnaces are oil fired, the double frame hammer having a locomotive type boiler above the furnace for generating steam. There are 17 coal fired forges in the shop. The blast for both the oil burning and the coal fired furnaces is furnished by two No. 7 blowers with direct connected motors. The blast carried at the blowers is at 15 ounces pressure and is distributed overhead by galvanized iron pipes to the forges, and underground in cast iron pipes.

Across the width of the shop for a distance of one panel in length is a space devoted to bolt finishing and here are placed two bolt cutters as well as a four-spindle staybolt machine of the vertical automatic type, and staybolt drilling and nicking machines. The machines are conveniently located here for the reason they can thread the bolts after they come from the blacksmith shop ready for delivering to the boiler and machine shops by shop trucks. There is a push car track down the center of the shop which connects the blacksmith shop with the machine shop for the purpose of handling very heavy forgings from the machine shop. However, most of the material is handled by storage battery or gasoline driven shop trucks on a concrete road which is laid down the center and to either side of the central push car track. There is also a concrete road crossing the shop near the center. The floor of the blacksmith shop is of cinders. Outside of the blacksmith shop and parallel to it are sheds for the storage of bar iron. These sheds are 24 ft. in width and 300 ft. in length, and in one end of the sheds are located bins for blacksmith shop coal.

Tin, pipe and welding shop

The tin, pipe, and welding shop is located between the blacksmith shop and the roundhouse, and is also connected with the machine shop by a push car track which enters panel No. 18 of that shop. The tin shop is equipped to handle all welding, tin, babbitt, and brass work, and in addition can do some work on shop order for the car department. As shown by the list of machinery this shop is well provided with equipment for such work.

The locomotive parts for brass and babbitt liners are delivered to and from the building by shop trucks. The brass hub liners are poured directly on the boxes from a 42-in. Swartz oil fired brass furnace; the boxes being handled by a 1½-ton overhead trolley hoist which also conveys the ladles. The east end of the tin shop is devoted to welding work which makes it convenient as this end of the shop faces onto the material platform which is between the tin shop and machine shop. The parts to be welded are delivered by an overhead crane in or near the welding booths. On the north side of the shop there are connections for electric welding, and on the south side there are three connections for gas welding. There is also provided a 6-ft. by 6-ft. preheating furnace and two preheating forges.

Outside of the tin shop are storage platforms with

racks for the storage of pipe and locomotive jackets. There is also a separate lye vat for cleaning the locomotive jackets.

The electric power for operating this shop is purchased from the Southern California Edison Company. However, the steam is generated by four 300-hp. water tube boilers located in the new powerhouse. Compressed air is furnished by two motor-driven air compressors of 3,500 cu. ft. capacity each, and one steam driven compressor of 2,000 cu. ft. capacity. Also, located in the power house are two motor driven generating sets for converting current from a.c. to d.c. to operate the large cranes and reversing planer in the machine shop, as well as some other machinery operating on direct current. The entire plant is piped for gas welding; acetylene is generated on the shop grounds in a building provided for that purpose, and the oxygen is supplied from portable pressure tanks which are connected to a manifold in the gas generating plant.

The entire locomotive department is supplied with fuel oil for furnaces and forges by an oil line which makes a complete circulating system throughout all the shops. This oil line is laid underground in tile pipe and is paralleled by a steam line for keeping the oil warm. Manholes are located at convenient distances so that the pipe can be drawn out and repaired. The fuel oil supply reservoir with pumps is located between the blacksmith shop and the power house.

For the convenience of the employes the shop is liberally supplied with wash room, toilet, and locker facilities. All lavatories are arranged so that men can wash under running water, and the locker rooms are equipped with steel lockers of liberal dimensions. There is also an apprentice

The well-lighted boiler shop machine bay

school room 30 by 56 ft., as well as a shopmen's assembly room.

A fire department building was constructed and equipped with modern motor-driven fire trucks which operate over concrete roadways connecting all departments.

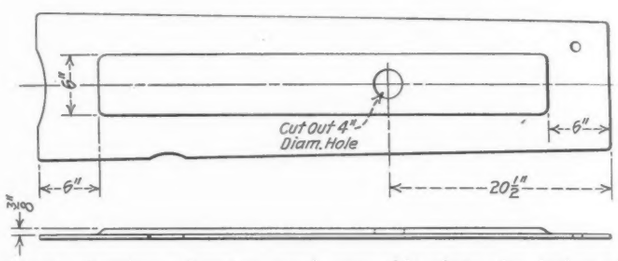
The mechanical equipment was designed and laid out under the general supervision of John Purcell, assistant to vice-president, by B. P. Phelps, engineer of shop extensions, collaborating with H. S. Wall, mechanical superintendent of the Coast Lines, and A. G. Armstrong and H. Bruce Harmon, superintendent and assistant superintendent, respectively, of the San Bernardino shops.

Making enginehouse booster repairs easier

By A. T. E.

IN order to make many of the heavy repairs to locomotive boosters, the eccentric rods of the booster engine must be removed and because of the close clearance between the crank case side plates and the eccentric crank and rachet arm pins, the side plates must either be removed or loosened and spring out. The removal and replacing of these plates while the booster is still under the locomotive is not only a disagreeable job, but with the plates sprung away it is difficult to be sure the gasket is perfectly clean and oil tight.

The side plates, however, need not be removed if the method outlined here is followed. When locomotives equipped with boosters go through the back shop for repairs, the booster side plates should be removed and given



Sketch showing a booster crank case side plate, the design of which facilitates the work of maintenance

a ⅜-in. offset, or dish, according to the dimensions shown in the sketch. Dies can be designed to make this offset under a press and either the old plates used or new ones made. If the old plates are used it is suggested that short pins or studs, be screwed into the bottom die to correspond to the bolt holes in the plate. The plate can then be held down by nuts, or preferably by an air clamp working in conjunction with the top die. If new plates are made, which is more desirable, a considerable saving can be made by pressing the required number of plates at one time, using no studs or air clamps in this operation. The holes can then be laid off to a template and the drilling, or punching, all done at one time. As there is always a demand for such plates around a back shop, the original side plates need not be scrapped, but can be cut up for shoe and wedge liners, guide liners, etc.

The plates shown in the sketch is for the left side of the crank case and is known as booster part No. 21522. The 4-in. diameter hole shown is used to facilitate the removal of the crosshead pin. The small hole shown in the upper back corner of the plate is tapped for an elbow through which the crank case is oiled.

While the application of this type of side plate is particularly helpful in making heavy repairs in the enginehouse, it will also be found helpful at the back shop where the booster is out from under the locomotive. The side plate gaskets rarely leak when kept properly tightened and their removal at the back shop should not be necessary unless the valves are to be run over in the manner indicated in the booster instruction book.

ATCHISON, TOPEKA & SANTA FE.—Plans have been prepared for the construction of a 43-stall enginehouse, several small shop buildings and extensive track facilities at Emporia, Kan. The project is estimated to cost approximately $500,000. The construction of the enginehouse and related facilities constitutes the second unit in the Santa Fe's development of a terminal at Emporia.

D. L. & W. has effective scheduling system

Increased production has been obtained by setting a "bulls-eye" for classified repairs

By E. A. Koschinske

Superintendent of shops, Delaware, Lackawanna & Western, Scranton, Pa.

REALIZING that it is essential to know just how long it should take to overhaul a locomotive with the least cost of operation, a simple but effective shop schedule has been developed within the past year at the Scranton locomotive shops of the Delaware, Lackawanna and Western. It was realized that in order to secure a desired output with the least possible cost of operation some effective plan would have to be developed for the handling of locomotives for classified repairs which would not be too elaborate or unwieldy. In beginning an analysis, the shop management made a detail study selecting each step or major operation in its proper sequence which would produce the desired results, anticipating what material would be needed and reducing lost motion, and corelating the work of the various departments involved so that the completion of each major operation would dovetail into the others.

In developing this schedule a bogie time constant was developed wherein the "bulls-eye" (the days allotted for completion of each classified repair) was such as to require a perfect corelation between the factors, time, material, manload and cost. The measuring stick used in planning this schedule was the piece work rate established for each operation in repairing of the locomotive based on an ideal manload for a Class Five repair and supplemented by research extending several years back.

It was developed that 10 eight-hour days was an ideal shop time constant for a Class Five repair, which calls for tires turned or new, general repairs to machinery and necessary repairs to the boiler, for any class of locomotive. The ideal manload in keeping with the carrying types of locomotives is determined by the immediate department foreman, his action being governed solely by the advance information which is given of work to be done together with the time it is to be performed in.

This research developed that giving a Class Five repair a factor of one, the following values were developed for the other classified repairs, namely: Class Four 1.36, Class Three 1.36, Class Two 2.77 and Class One 2.77. In cases of exceptionally heavy boiler work on a Class Three repair a factor of 1.6 was developed, giving a true time value of 10 days to factor one or Class Five repairs and maintaining the above ratio. We have the following time values for classified repairs:

Class	Days
Five	10
Four	14
Three	14
Three (heavy)	16
Two	28
One	28

Likewise 28 actual working days are allowed for the application of a superheater, stoker or valve gear.

A key to the major schedule, Table I, was formulated wherein 28 major operations in their proper sequence are shown, starting from the time of dismantling the locomotive and following up step by step until the repair work is finished. This is the predetermined time given to complete major operations as outlined to the department or assistant foreman. The planning of work in this manner aids materially in assisting the foremen properly to assign their employees to the work in hand and gives definite instructions to the foremen in each department as to when their operations must be completed. This does away with the practice used in most shops where the schedule is planned each month and all efforts are centered on *output*, losing sight entirely of the *input*, with the result that at the end of the month it is found that their output is below the estimate on account of no actual shop production control being in effect.

Table I—Key used in connection with major schedule

Major operations	Cls. 5 10 Days	Cls. 3 & 4 14 Days	Cls. 3 16 Days	Cls. 2-3C 3B-D 28 Days
Unwheeled	1	1	1	1
Pipe work off	1	1	1	1
Jacket and lagging off	2	2	2	2
Motion work in vat	2	2	2	2
O.K. for boilermakers	2	2	2	2
All material delivered	3	3	3	3
Spring rigging from smith shop	4	6	8	10
Truck work from smith shop	4	6	8	10
Brake work from smith shop	4	6	8	10
Flues out	..	3	3	3
Boxes from foundry	5	5	5	5
Cab work	6	8	9	22
Bolting	6	9	10	22
Shoes and wedges L.O.	6	8	10	22
Wheels and boxes	7	8	10	22
Rods complete	7	8	10	22
Pistons, crossheads and guides	7	11	13	23
Boiler test	7	10	13	23
Jacket and lagging O.K.	8	11	14	24
Spring rigging O.K.	7	10	11	23
Steam chests	7	9	11	22
Engine wheeled	8	10	12	24
Motion work	8	10	12	23
Brake work	9	13	15	27
Tank out	9	13	15	25
Pipe work up	10	14	16	28
Engine painted	10	14	16	28
Engine out	10	14	16	28

In making up the key used in connection with the master schedule great care was exercised in the order given and the time allowed was based on the form, or graphic chart, shown in Table I, which shows the exact sequence and interlocking of major operations on the input side. Table I was used at first in developing the scheduling system, having particular reference to the input.

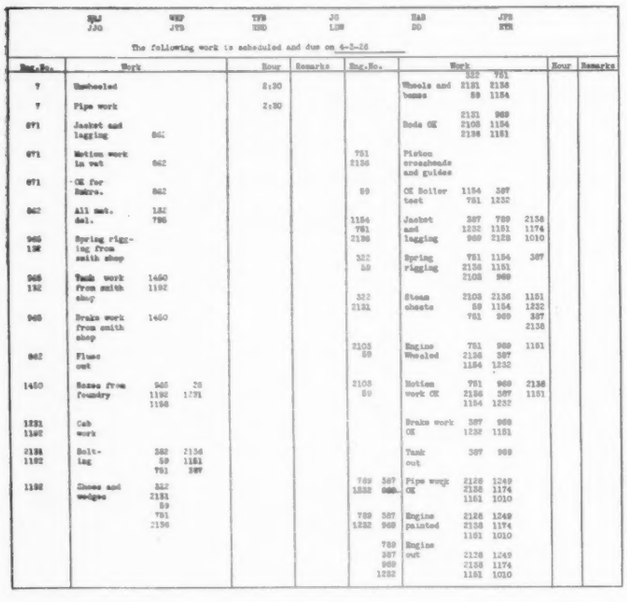
Sixty days prior to the shopping of locomotives, which is determined by federal requirements, tire wear and general condition, the major defects and shop requirements are shown on a form made out by the respective master mechanics a copy of which is sent to the superintendent of locomotive shops. These forms show the unusual conditions which have been developed and allow ample time for furnishing all necessary material, special appliances, etc.

When a locomotive is received for classified repairs, a report of its condition is received, the analysis of which determines what class of repairs, are to be made. The

class of repair is determined and a form illustrated is filled out on which all necessary information is given, namely: the number of the locomotive, the date and time placed in the shop, predetermined dates allowed for each major operation, the class of repair, the number of actual working days, federal requirements, such as hydrostatic test, renewal of staybolt caps, flues, jacket and lagging, and boiler wash.

A copy of this form is furnished to each department foreman prior to placing the locomotive in the shop. The information given on this form is so complete that each department knows in advance just how long it should take to overhaul a locomotive. It has been proved that the various department and assistant foremen can better visualize their work as they know the length of time allotted to them and when their work should be ready.

All the information placed on the above form when the locomotive arrives in the shop is incorporated on a master schedule chart, on which the completion of each major operation is checked and a record made as to



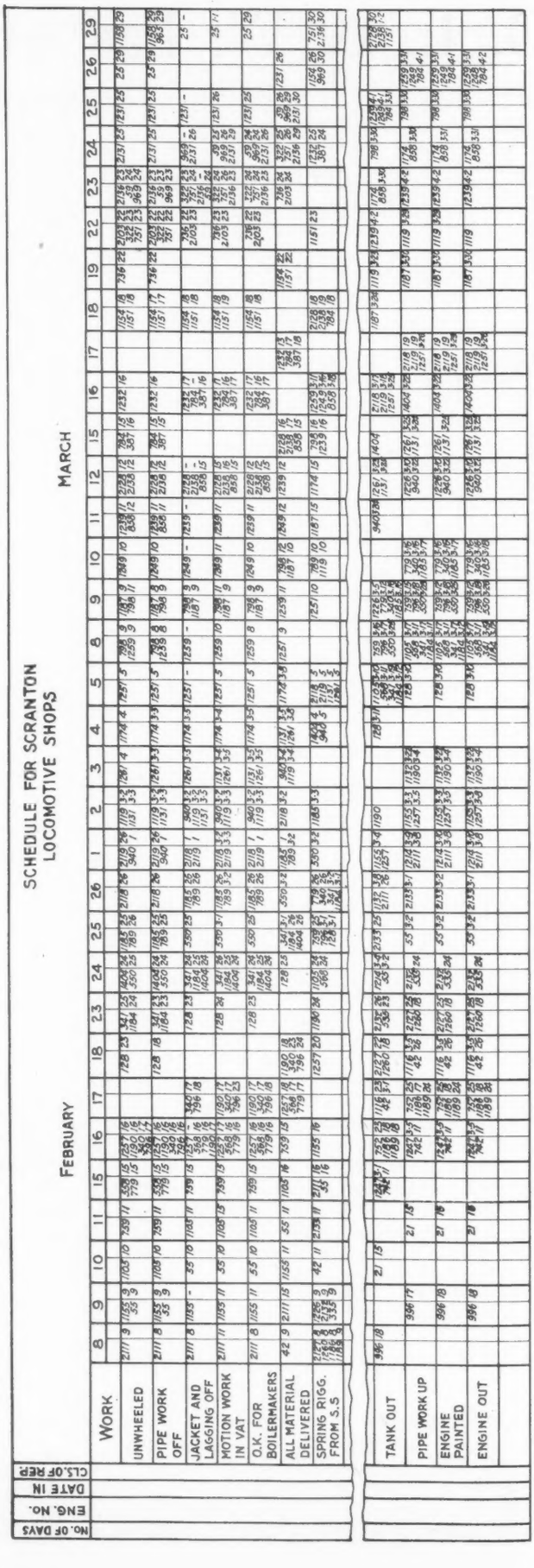
The following work is scheduled and due on 4-3-26

Eng.No.	Work	Hour	Remarks	Eng.No.	Work	Hour	Remarks
7	Unwheeled	2:30			322 751 Wheels and 2131 2136 boxes 89 1154		
7	Pipe work	2:30			2131 969 Rods OK 2105 1154 2136 1161		
871	Jacket and lagging 862						
871	Motion work in vat 862			751 2136	Piston crossheads and guides		
871	OK for Bakrs. 862			89	OK Boiler 1154 307 test 751 1232		
862	All mat. del. 132 796			1154 751 2136	Jacket 307 789 2136 and 1232 1181 1174 lagging 969 2128 1010		
965 192	Spring rigging from smith shop			322 58	Spring 751 1154 307 rigging 2136 1161 2105 969		
965 192	Tank work from smith shop 1460 1192			322 2131	Steam 2105 2136 1161 chests 89 1154 1232 751 969 307 2136		
965	Brake work from smith shop 1460			2105 89	Engine 751 969 1161 Wheeled 2136 307 1154 1232		
862	Flues out			2105 89	Motion 751 969 2136 work OK 2136 307 1161 1154 1232		
1460	Bosse from foundry 965 28 1192 1791 1198				Brake work 307 969 OK 1232 1161		
1231 1192	Cab work				Tank out 307 969		
2131 1192	Bolting 382 2136 89 1161 791 307						
1192	Shoes and wedges 322 2131 89 791 2136			789 1232	307 969 Pipe work 2128 1249 OK 2136 1174 1161 1010		
				789 1232	307 969 Engine 2128 1249 painted 2136 1174 1161 1010		
				789 307 969 1232	Engine out 2128 1249 2136 1174 1161 1010		

Form known as the "Yellow Dog" which shows the progress of repair work on each locomotive going through the shop

whether it was performed in the prescribed time or not. In addition to this form there is an additional form which is issued daily by the shop general foreman's office and a copy delivered to each department foreman, calling to his attention the operations that are expected to be completed by his department that day. The form, also illustrated, is commonly referred to by the supervisors as the "yellow dog," it being typed on yellow paper, because "go where they will it persists in following them and can't be shaken off."

Each department foreman at the close of the day's work returns this form to the general foreman's office with his written comments thereon as to whether or not the major operations due that date were completed, and if not, why. When the department foremen check the major operations on this form they not only check those that they are directly responsible for, but also those major operations which should be completed in their proper sequence and delivered to the various departments concerned. When this form or "yellow dog" is turned into the general foreman's office by each department foreman it is analyzed and those operations which were not com-



Form showing the number of locomotives for which each major operation is complete d each day

SUMMARY OF THE SCRANTON LOCOMOTIVE SHOP SCHEDULE
MARCH 1926

TOTAL NUMBER OF ACTUAL WORKING DAYS FOR MONTH 23. HOURS PER DAY 8.

Engine Number	Date in Shop	No. of Days Scheduled	Cls. of Reprs.	Unwheeled	Pipe Work Off	Jacket and Lagging Off	Motion Wk. in Vat	O.K. for Boilermkrs.	All Mtl. Del.	Spring Rigg. from S.S.	Truck Work from S.S.	Brake Work from S.S.	Flues Out	Boxes from Foundry	Cab Work	Bolting	Shoes and Wedges L.O.	Wheels and Boxes
2132	2-1	14	3	2-2	2-2	2-2	2-2	2-2	2-3	2-9	2-9	2-9	2-3	2-8	2-11	2-15	2-11	2-11
				2-3	2-2	–	2-3	2-2	2-8	2-9	2-9	2-9	2-8	2-10	2-11	2-15	2-17	2-17
2133	2-1	16	3	2-2	2-2	2-2	2-2	2-2	2-3	2-11	2-11	2-11	2-3	2-8	2-15	2-16	2-16	2-16
				2-3	2-2	–	2-8	2-2	2-8	2-11	2-11	2-11	2-3	2-11	2-15	2-18	2-18	2-23
55	2-8	10	5	2-9	2-9	2-10	2-10	2-10	2-11	2-15	2-15	2-15	2-11	2-16	2-17	2-17	2-17	2-18
				2-9	2-9	2-10	2-10	2-10	2-11	2-15	–	2-15	–	2-16	2-17	2-18	2-18	2-23
1155	2-4	14	4	2-9	2-9	2-9	2-9	2-9	2-10	2-16	2-16	2-16	2-10	2-15	2-18	2-23	2-18	2-18
				2-9	2-9	–	2-11	2-9	2-11	2-16	2-16	2-16	2-10	2-15	2-18	2-26	2-18	2-18
1190	2-15	10	5	2-16	2-16	2-16	2-17	2-17	2-18	2-23	2-23	2-23	2-18	2-24	2-25	2-25	2-25	2-26
				2-16	2-16	2-17	2-17	2-17	2-18	2-24	2-24	2-23	–	2-24	2-25	2-25	2-26	2-26
1247	1-19	16	3	1-21	1-21	1-21	1-21	1-21	1-25	2-2	2-2	2-2	1-25	1-27	2-3	2-4	2-4	2-4
				1-21	1-21	1-21	1-25	1-21	1-25	2-2	2-2	2-2	2-2	1-27	2-4	2-4	2-4	2-4
1116	1-21	16	3	1-25	1-25	1-26	1-26	1-26	1-27	2-4	2-4	2-4	1-27	2-1	2-8	2-9	2-9	2-9
				1-25	1-25	1-26	1-27	1-26	1-27	2-4	2-4	2-4	2-1	2-2	2-8	2-17	2-9	2-8
1257	2-11	10	5	2-16	2-16	2-16	2-16	2-16	2-17	2-18	2-18	2-18	2-17	2-23	2-24	2-24	2-24	2-25
				2-16	2-16	–	2-17	2-16	2-18	2-20	2-18	2-20	–	2-24	2-24	2-26	2-26	3-1
2111	2-3	14	4	2-8	2-8	2-8	2-8	2-8	2-9	2-15	2-15	2-15	2-9	2-11	2-17	2-18	2-17	2-17
				2-9	2-8	2-8	2-11	2-8	2-15	2-16	2-15	2-15	2-15	2-15	2-17	2-18	2-24	3-2
1214	1-11	28	38	1-13	1-13	1-13	1-13	1-13	1-14	1-27	1-27	1-27	1-14	1-19	1-17	2-17	2-17	2-17
				1-12	1-13	1-18	1-13	1-13	1-14	1-27	1-27	1-27	1-20	1-21	2-17	2-17	2-9	2-17
1226	1-26	28	38	1-28	1-28	1-28	1-28	1-28	2-1	2-9	2-9	2-9	2-1	2-3	3-4	3-4	3-4	3-4
				1-28	1-28	1-28	2-1	1-28	2-2	2-9	2-9	2-9	2-8	2-4	3-4	2-25	2-25	3-4
128	2-17	10	5	2-18	2-18	2-23	2-23	2-23	2-24	2-25	2-25	2-25	2-24	2-26	3-1	3-1	3-1	3-2
				2-23	2-18	2-23	2-24	2-23	2-25	3-1	–	2-26	–	3-4	3-1	3-5	3-4	3-4
568	2-11	14	3	2-15	2-15	2-16	2-16	2-16	2-17	2-24	2-24	2-26	2-17	2-23	2-26	3-1	2-26	2-26
				2-15	2-15	2-16	2-16	2-16	2-17	2-24	2-24	2-24	2-17	2-23	2-26	3-2	3-1	3-2

Engine Number	Rods O.K.	Pistons, Xhds. and Guides	Boiler Test	Jacket and Lagging Up	Spring Rigg. Up	Steam Chests	Engine Wheeled	Motion Work O.K.	Brake Work Up	Tank Out	Pipe Work Up	Engine Painted	Engine Out	No. of Days Overdue	Total No. of Days in Shop	Remarks
2132	2-11	2-17	2-16	2-17	2-16	2-15	2-16	2-16	2-23	2-23	2-24	2-24	2-24	3	17	Flues not out and Mtl. not stripped acct excessive stripping on other engs.
	2-11	2-23	2-25	2-25	2-23	2-17	2-24	2-23	2-25	2-26	3-1	3-1	3-1			
2133	2-16	2-23	2-23	2-24	2-17	2-17	2-18	2-18	2-25	2-25	2-26	2-26	2-26	1	17	Stripping not cov. promptly acct of excessive Strip. on other eng. Flues delayed in B.S
	2-17	2-23	2-26	2-26	2-24	2-18	2-25	2-24	2-26	2-25	3-1	3-2	3-1			
55	2-18	2-18	2-18	2-23	2-18	2-18	2-23	2-23	2-24	2-24	2-25	2-25	2-25	3	13	Delayed acct. Throttle Work Mach. not ready for test
	2-18	2-23	2-24	3-1	2-23	2-23	2-25	2-26	3-1	3-2	3-2	3-2	3-2			
1155	2-18	2-25	2-24	2-25	2-24	2-23	2-24	2-24	3-1	3-1	3-2	3-2	3-2	1	15	Flues delayed in B.S. Bolting acct. Mach. Shop
	2-18	2-25	3-1	3-2	2-26	2-25	2-26	2-26	3-1	3-4	3-3	3-3	3-3			
1190	2-26	2-26	2-26	3-1	2-26	2-26	3-1	3-1	3-2	3-2	3-3	3-3	3-3	1	11	Motion Work and Boiler Work
	3-1	3-1	3-2	3-3	3-1	3-2	3-2	3-4	3-3	3-3	3-4	3-4	3-4			
1247	2-4	2-10	2-10	2-11	2-8	2-8	2-9	2-9	2-15	2-15	2-16	2-16	2-16	11	27	Delayed acct. of excessive Boiler Work
	2-4	2-10	3-3	3-5	2-23	2-9	2-23	2-9	2-24	3-1	3-5	3-5	3-5			
1116	2-9	2-15	2-15	2-16	2-10	2-10	2-11	2-11	2-17	2-17	2-18	2-18	2-18	9	25	Wheeling delayed acct. waiting on Sh. for Dr. Springs. Test delayed acct. Flues, Slow in B.S.
	2-9	2-15	3-2	3-5	2-16	2-11	2-17	2-11	2-18	2-23	3-5	3-5	3-5			
1257	2-25	2-25	2-25	2-26	2-25	2-25	2-26	2-26	3-1	3-1	3-2	3-2	3-2	4	14	Bolting acct. Mach. Shop Motion Work Slow. Pistons delayed acct. waiting on Sh. for Dunbar P.
	2-25	3-5	2-26	3-4	3-3	3-2	3-4	3-4	3-4	3-3	3-5	3-5	3-8			
2111	2-17	2-20	2-23	2-24	3-23	2-18	2-23	2-23	2-26	2-26	3-1	3-1	3-1	5	19	Stripping and del. Slow acct. excess. stripping on other Engs. Flues Slow. Jacket and Lagg. Slow
	2-18	2-24	3-4	3-8	3-1	2-18	3-2	2-26	3-3	2-26	3-8	3-8	3-8			
1214	2-17	2-18	2-18	2-22	2-18	2-17	2-22	2-18	2-26	2-24	3-1	3-1	3-1	7	35	Excessive Boiler Work. Pistons held up acct. waiting on Dunbar packing
	2-17	3-5	3-3	3-9	3-3	2-17	3-3	2-18	3-4	3-4	3-9	3-10	3-10			
1226	3-4	3-5	3-5	3-8	3-5	3-4	3-9	3-5	3-11	3-9	3-12	3-12	3-12	②	26	
	3-4	3-8	3-7	3-8	3-5	2-25	3-5	3-5	3-10	3-5	3-10	3-10	3-10			
128	3-2	3-2	3-2	3-3	3-2	3-2	3-3	3-3	3-4	3-4	3-5	3-5	3-5	3	13	Bolting not cov. promptly Test delayed acct. Mach.
	3-3	3-4	3-2	3-8	3-5	3-4	3-8	3-8	3-10	3-11	3-10	3-10	3-10			
568	2-26	3-3	3-2	3-3	3-2	3-1	3-2	3-2	3-5	3-5	3-8	3-8	3-8	3	17	Flues delayed in B.S.
	3-3	3-4	3-8	3-9	3-8	3-4	3-8	3-5	3-10	3-11	3-11	3-11	3-11			

This form showing the sequence of operations is maintained by the shop general foreman

pleted as scheduled are noted and this information is given to both the general foreman and superintendent of shops. They, in turn, personally check up the cause of any delay and take necessary corrective action. This has proved very effective as it keeps the shop supervision keyed up and advised as to the progress of work.

The form known as a summary schedule is maintained by the shop general foreman showing the exact sequence of major operations as found on the individual locomotive form. As locomotives are received in the shop the numbers are entered on the summary schedule together with the date of arrival in the shop, class of repair and number of scheduled shop days contingent on the class of repairs. Horizontally across this form under each operation heading is found the predetermined completion date or "bulls-eye" for each major operation, and upon the completion of each major operation the date is shown directly under the predetermined date. On the right hand side of this master chart is shown the number of days each locomo-

WEP JTB HRJ JJO TFB RND JG LDW HAB DD JPS ETR

The work on engine 132 in shop 3-30 at 3:30 p.m. is scheduled as follows:

Work	Date	Hr.	Rem.	Work	Date	Hr.	Rem.
Unwheeled	3-31	2:30		Wheels and boxes	4-7		
Pipe work	3-31	2:30		Rods completed	4-7		
Jacket and lagging, off	4-1	10:00		Pistons, crossheads, guides	4-7		
Motion work in vat	4-1	3:30		Boiler test	4-7		
OK for boilermakers	4-1	3:30		Jacket and lagging on	4-8		
All material delivered	4-2	3:30		Spring rigging	4-7		
Spring rigg. from smith shop	4-3			Steam chests	4-7		
Truck work from smith shop	4-3			Eng. wheeled	4-8		
Brake work from smith shop	4-3			Motion work OK	4-8		
Flues out	No			Brake work OK	4-9		
Boxes from foundry	4-5			Tank out	4-9		
Cab work	4-6			Pipe work OK	4-10		
Bolting	4-6			Eng. painted	4-10		
Shoes and wedges laid out	4-6			Eng. out	4-10		

Jacket and lagging All off
Hydro. test Yes
Caps Yes
Wash Yes
Flues Yes

Class of repairs 5
No. of days 10

Form showing the time the work on each locomotive is scheduled for each department

tive is held in the shop over the predetermined schedule, and in another column is shown the total number of days in shop. On the extreme right is a column for explaining in detail the exact causes for failure to meet the predetermined date.

Among many of the outstanding benefits derived from this form of scheduling system is the fact that it allows the chief shop executive to locate any stagnant condition in his production and he can place his finger on any unbalanced condition that may develop. This scheduling system has developed cases where several departments were undermanned, while others were overmanned, which allowed immediate correction.

A perfect rhythm and as near perfect co-operation has been created between the various departments as is possible. Sincere enthusiasm has been created among the supervisors which has percolated down through the ranks, each man knowing where he should fit to best advantage.

It may be of interest to note the reduction in the shop days that locomotives are undergoing various classified repairs. The following is the condition for the period:

Month	Behind the given predetermined time, per cent	Month	Behind the given predetermined time, per cent
March, 1925	104	August	55
April	87	September	74
May	70	October	73
June	92	November	57
July	69	December	63

This is an average for 10 months of 74 per cent behind the given predetermined schedule; in January, 1926, 56 per cent behind the given predetermined schedule, February 63 per cent and March 49 per cent.

As this scheduling system is becoming more effective there are indications of closer approach to the predetermined scheduled dates. It is also interesting to note the increasing efficiency of labor costs on a monthly basis which are as follows:

Month	Efficiency, per cent	Month	Efficiency, per cent
March, 1925	54	August	82
April	60	September	68
May	58	October	75
June	75	November	70
July	70	December	88

This gives us an average of 68 per cent efficiency in 10 months for the year 1925. In the month of January, 1926, 75 per cent efficiency; February, 1926, 90 per cent, and March, 1926, 93 per cent.

In conclusion, it might be well to say that at the Scranton locomotive shops of the Delaware, Lackawanna and Western this scheduling system has come to be an absolute necessity and within the last several months has been put in effect at all locomotive repair shops on the system.

Each month copies of the summary schedule showing the output from each shop are sent respectively to the superintendent of motive power and equipment, and to the operating vice-president and manager.

Air brake convention meets at New Orleans

Members and guests numbering 852 attend highly successful convention—51 railway supply companies exhibit devices

THE Air Brake Association held its 33rd annual convention at the Hotel Roosevelt, New Orleans, La., on May 4 to 7, inclusive, and this convention was the largest and in many respects the most successful in the history of the association. The final registration was 852 members and guests, and 51 supply companies were represented in the exhibit.

A number of the reports were of exceptional value and in addition to hearing and discussing these reports the members of the association had an opportunity to study, in the exhibition hall, the fine points of practically all of the equipment encountered in their daily routine of duty. The value of the exhibit this year was strongly emphasized on the convention floor by several members who said that the technical information furnished by the engineers and experts of the supply companies has become an important feature of the convention.

R. C. Burns (Pennsylvania), president

M. S. Belk (Southern), first vice-president

H. A. Clark (Soo Lines), second vice-president

H. L. Sandhas (C. R. R. of N. J.), third vice-president

Election of officers

Following the reading of reports and the discussion of new business, the association elected the following officers for the ensuing year: President, M. S. Belk, general air brake instructor, Southern, Washington, D. C.; first vice-president, H. A. Clark, general air brake inspector, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn.; second vice-president, H. L. Sandhas, general inspector, Central of New Jersey, Allentown, Pa.; and third vice-president, W. W. White, supervisor air brakes, Michigan Central, Detroit, Mich. Otto Best, Nathan Manufacturing Company, New York, was returned to the position of treasurer, F. M. Nellis, Westinghouse Air Brake Company, New York, being permanent secretary. One new member was elected to the executive committee: E. C. Mann, Atlantic Coast Line.

The Air Brake Appliance Association held its annual meeting during the convention and elected the following officers: President, Fred Speer, Gustin-Bacon Manufacturing Company, Philadelphia, Pa.; and secretary-treasurer, J. H. Ainsworth, A. M. Byers Company, Pittsburgh, Pa. The terms of three of the executive committee members expired and the following were elected to take their places: C. R. Busch, Buffalo Brake Beam Com-

pany, New York; W. A. Housten, Joseph Dixon Crucible Company, Baltimore, Md.; and R. F. Duysters, Simmons-Boardman Publishing Co., New York.

President Burns' address

Like every other division of railroad transportation, the air brake must, of necessity, keep pace with the constantly increasing developments and improvements in the more efficient and safe handling of passengers and lading. This necessitates constant vigilance in the way of practical apparatus, installation and maintenance. Many rules and regulations are essential in order that equipment from one road may be thoroughly interchangeable as to functioning and performance on another. Without such regulations we could not expect to progress, and in order that our progress may continue, it is vitally important that air brake men fulfill their duty in seeing that regulations are carried out.

When we look broadly upon the accomplishments of railroads in this country, as compared with those abroad, in facilitating exchange of freight, we have just reason to feel proud of our work. A freight car loaded in Canada can be transported to any part of this great continent without any change in its equipment or transfer of its lading.

While a healthy rivalry and competition exists among properties under separate ownership, there is no selfish division between the officers and employees of one road and those of another when it comes to matters pertaining to the common good. This is an accomplishment in which we, as air brake men, have had a prominent part, and we are, therefore, justly entitled to a feeling of pride in our vocation and in the railroad air brake department which we represent.

The safety factor, though of essential importance, is but a part of our extensive field of endeavor. The brake equipment must be equal to the demands of traffic in every particular and still render the required service as to safety.

You are aware of the efforts being made by the American Railway Association to analyze the existing equipments and the art of controlling trains by means of air brakes in general, with a view toward formulating improvements wherever possible or desirable. This is in the common interest of all railroads of the country. We shall await with much interest the results of these studies, and I bespeak for this association your whole-hearted cooperation and willingness to render any service that may be desired.

During the convention the following reports and papers were discussed: Committee report on hose coupling gages; Retaining valve testing, Central Air Brake Club; Triple valve repairs, Central Air Brake Club; Committee report on review and comments on tolerances of triple valve dimensions in repair work; Modern freight train handling, St. Louis Air Brake Club; Better insulation of steam cylinders of air compressors, by C. B. Miles; Recent improvements in passenger train braking; Committee report on brake pipe leakage; Cutting and bending of air brake pipe, Pittsburgh Air Brake Club; Committee report on recommended practice, and Train control, by George H. Wood, H. L. Sandhas and others. Abstracts of the reports bearing more particularly on the application and maintenance of air brake equipment will appear in a later issue.

Fuel convention a big success

Attendance at four-day meeting included officers of many departments—Addresses by several executives

A PROGRAM of subjects bearing on the relation to fuel economy of practically all departments of the railroad organization at the eighteenth annual meeting of the International Railway Fuel Association held at the Hotel Sherman, Chicago, May 11 to 14, received the sustained attention of one of the largest, if not the largest, attendances in the history of the organization. This attendance was made up of executives, officers from various departments, and a large number of men from engine and train service on railroads all over North America, as well as the officers and supervisors dealing specially with the purchase, inspection, distribution and use of fuel. Following out a practice which was very favorably received at last year's convention, the subjects were grouped so that those of special interest to operating men were presented on the first day; those of special interest to the accounting, engineering and purchasing departments were presented on the second day, and those of special interest to the mechanical department were presented on the third and fourth days.

The convention was called to order by the president, J. W. Dodge, Illinois Central, who, after a brief address, introduced A. E. Clift, senior vice-president of the Illinois Central. Mr. Clift in his address reviewed the accomplishments of the American railroads up to the present time and outlined some of the changes in the character of railroad development and in the relationships between the railroad and the public which have recently been taking place. He concluded by calling attention to the part which fuel organizations have played in increasing the efficiency with which the railroads have been operated during the past few years, with a reduction in fuel consumption per unit of freight service of 19.3 per cent from 1920 to 1925, and 6.5 per cent from 1924 to 1925, and corresponding reductions per unit of passenger service of 14.3 per cent and 5.3 per cent, respectively, resulting in a saving 24,467,000 tons in both branches of the service in 1925, on the basis of traffic handled in that year, as compared with 1920, and of 7,302,000 tons as compared with 1924.

D. H. Pape, assistant to executive secretary, National Coal Association, in an address on the factors affecting fuel cost and distribution, presented a comprehensive survey of the economic factors affecting the bituminous coal industry and their relationship to the railroads, in which he expressed his belief that both the mining and transportation industries have a common interest in educating the coal consuming public to an understanding of the burden which it ultimately bears as the result of excess mine capacity and excess transportation capacity because of its failure to permit the mining and transportation of its coal requirements at a uniform rate throughout the year.

Other addresses were made before the convention by

H. R. Safford, vice-president, Missouri Pacific, who spoke on engineering factors in fuel conservation; J. J. Ekin, controller, Baltimore & Ohio, who discussed accounting factors in fuel conservation; R. J. Elliott, purchasing agent, Northern Pacific, who spoke on the relation of coal to dividends, and C. E. Brooks, chief of motive power, Canadian National, who discussed some of the mechanical factors in fuel economy confronting the railroads today.

Committee reports were presented on the following subjects: Division fuel meetings, O. J. Brown (B. & M.), chairman; Recording miscellaneous fuel disbursements, B. A. McDowell (B. & O.), chairman; Fuel stations, L. J. Joffray (I. C.), chairman; Stationary plants, R. S. Twogood (S. P.), chairman; Storage of coal and fuel oil, Glenn Warner (P. M.), chairman; Inspection, preparation and analysis of fuel, Malcolm Macfarlane (N. Y. C.), chairman; New locomotive economy devices, E. E. Chapman (A. T. & S. F.), chairman; Firing practice, D. C. Buell (Railway Educational Bureau), chairman; Front ends, grates and ash pans, Prof. E. C. Schmidt (University of Illinois), chairman. Included with the report of the Committee on New Locomotive Economy Devices was a paper on back pressure as an index to fuel economy, by R. W. Retterer (Big Four), the discussion of which was carried over from the 1925 convention. During several of the sessions considerable time was also devoted to open forum discussions of various phases of the fuel economy problem of the railroads.

Other business

At the closing session of the convention the following officers were elected to serve for the coming year: President, E. E. Chapman, engineer of tests, A. T. & S. F.; vice-presidents, J. E. Davenport, superintendent, N. Y. C.; W. J. Tapp, fuel supervisor, D. & R. G. W., and T. C. Hudson, assistant general superintendent motive power, Canadian National. Four members were elected to the Executive Committee as follows: C. H. Dyson, assistant fuel agent, B. & O.; C. I. Evans, chief fuel supervisor, M.-K.-T.; V. L. Jones, assistant mechanical engineer, N. Y. N. H. & H., and L. P. Michael, mechanical engineer, C. & N. W.

The Executive Committee at a meeting following the close of the convention, decided on May 10, 1927, as the date for the commencement of the next convention, which will be held at Chicago.

The exhibit

The exhibit organized by the National Railway Supply Men's Association in connection with the meeting of the International Fuel Association, was unusually extensive this year. It was participated in by seventy companies, in addition to the parlor space provided by a number of coal companies. This was one of the largest exhibits ever held by the association.

At the meeting of the exhibiting organization held during the continuance of the exhibit, the following officers were elected for next year: President, F. S. Wilcoxen, Edna Brass Company; vice-president, F. P. Roesch, Standard Stoker Company; secretary, W. H. Harris, W. H. Harris Coal Company; treasurer, M. K. Tate, Lima Locomotive Works, Inc. Two new members of the Executive Committee were elected as follows: D. A. Witt, Detroit Lubricator Company, and E. H. Cooke, American Arch Company.

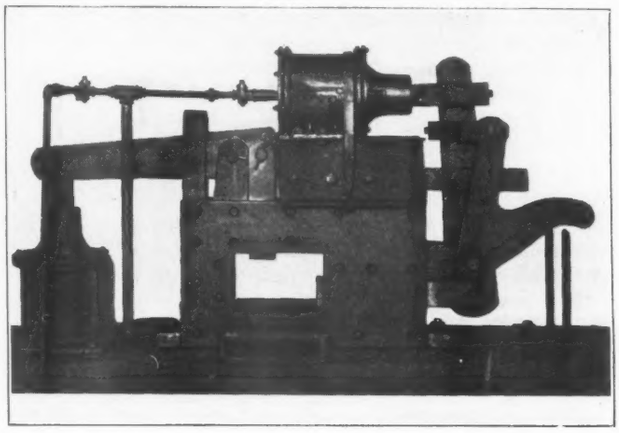
Abstracts of a number of the reports presented and discussed at the convention will appear in later issues of this magazine.

Spring banding machine

By B. J. Starke

LOCOMOTIVE driving and trailer track springs require, at different times, rebanding owing to loose spring bands and shifted leaves. To do this work by hand is not only slow but the finished job is not entirely satisfactory. The machine shown in the illustration, which was made in the Chicago & North Western shops at Kaukauna, Wis., not only increased production 40 per cent over the hand method but also eliminated the trouble of loose springs, for which purpose the machine was primarily designed.

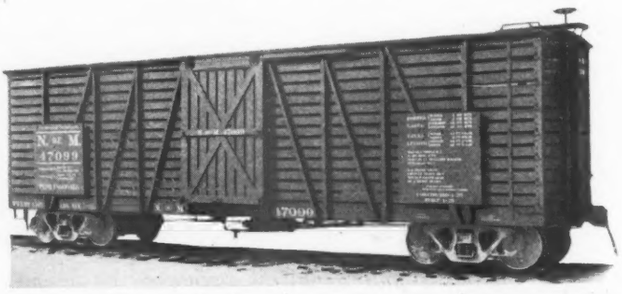
The machine was made mostly from scrap material such as parts of engine frames, an old planer bed, boiler steel and a few forgings. The machine primarily consists of two 12-in. brake cylinders which operate a series of



Spring banding machine built of scrap material, which has increased production 40 per cent

levers. The horizontal cylinder performs two functions; first, it operates the V-shaped arm at the right, the purpose of which is to do away with the old clamp and screw method of bringing the spring leaves together prior to applying the band; second, it compresses one side of the spring band. When the spring with the heated band is properly blocked in position, the horizontal plunger is first applied and held under pressure, while the vertical plunger is applied.

The leverage on the fulcrum arm is five to one. A safety yoke on both fulcrum arms prevents the piston from making the full stroke and thus applying pressure on the top head of the brake cylinders which is undesirable. All the pins and rollers are case hardened. The operating pressure is 75 lb.



Stock car built for the National Railways of Mexico by the Pressed Steel Car Company

New and Improved Machine Tools and Shop Equipment

Pratt & Whitney model B 20-in. lathe

A NEW lathe has just been added added to the line of Model B lathes manufactured by the Pratt & Whitney Company, Hartford, Conn.—a division of the Niles-Bement-Pond Company, New York. This new lathe is somewhat similar to the 13 and 16-in. sizes, but the increased swing with the necessary extra power and strength has resulted in several interesting departures from the standard Model B design.

The large model is designed primarily for motor drive and uses the same general scheme of mounting the motor as the other machines. By placing the motor in a cabinet leg beneath the headstock, it is not only out of the way, but is so far below the center of gravity that vibration from this source is practically eliminated. The result is a quiet, solid machine, with plenty of power to carry the heavy cuts which this size of lathe is often called on to take.

A 7½ hp. motor is the regular equipment recommended for the machine and is regularly installed equipped with push button control, low voltage protection and full electrical equipment. The drive may also be by means of a constant speed single pulley belted to a lineshaft.

The drive is carried by a belt to the main drive shaft located at the rear of the machine and is thence carried to the headstock and feed mechanism through gearing. A friction clutch operated by a shoulder high control rod running the length of the bed controls the power coming into the machine. This control rod forms a convenient device for throwing the power on and off without stopping the motor. The clutch is a standard No. 6 Johnson friction clutch running in oil.

The new 20-in. lathe has 16 spindle speeds instead of the usual eight. A lathe of this size is frequently used in toolrooms to swing large jig work in which both small and large holes are to be bored. To do such work efficiently, the greater speed range is needed.

The geared head is of the same general design as the 16-in. Model B lathe. The speed changes are handled by the same convenient speed change levers from the front of the headstock, except that there is an extra lever which shifts a high and low range speed change on the main drive shaft. A range of 16 spindle speeds is provided, from 8 to 383 r.p.m. The back gears are situated beneath the spindle nose which gives them a vertical motion for engaging and disengaging. This location completely does away with overhanging parts, and the result is a compact and symmetrical headstock which does not in any way hinder the maximum amount of light from reaching the work centers.

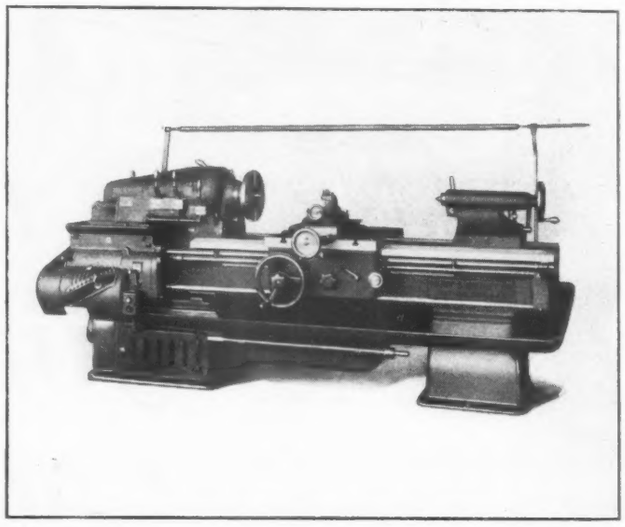
The back gear lock takes the form of a gear clutch. This is simply a pair of spur gears which slide back and forth inside of two internal gears so that when the spur gears are shifted to the left, the back gears may be engaged and when shifted to the right a positive connection is formed between the spindle nose and the spindle speed change gears. Thus it is possible to throw in the back gears and operate the lock by merely moving the spindle through a distance corresponding to the width of one tooth instead of feeling for the hole with the spindle locking pin, as was the case with older types of lathes.

The oiling of the headstock is particularly noteworthy. The lower gears of the headstock train dip into a reservoir of oil and splash-oil the others. In addition to this, there is a geared pump which sends oil up to a spreader. This spreader sprays the oil over the top of the entire gear train.

The hole through the spindle is 2 in. in diameter and the taper hole in the spindle nose is ground to a No. 19 Jarno taper. The spindle nose has both flat and tapered seats in addition to the threaded portion so that an accurate face plate seating is always assured.

Leading down from the spindle, a train of gears carries the power to the feed gear box which is situated at the front of the machine. This gear box is designed so that a rocker lever and a ratio lever work in unison with a direct reading index plate, and any desired feed or thread per inch may be instantly set by placing these two levers in the correct relation to the one plate. Thus there is no reading of charts with their chances for error. The range of 36 threads is from 1 to 56 pitch, while the feeds range from .0030 in. to .1667 in. for both carriage and cross feeds. By combining the two power feeds, a 45-deg. taper may be cut.

Both a lead screw and a feed rod are provided. A small gear shifting device is so arranged that when the feed rod is being used, the lead screw is idle and vice versa. In addition to the lead screw and feed rod, a stop and reverse rod runs the length of the bed. It is so placed that it will protect the lead screw from damage from falling tools or work. This rod forms a convenient method of controlling the feed of the tool.



The model B20-in. lathe is available in three bed lengths with 48-in., 72-in., and 96-in. center distances, respectively

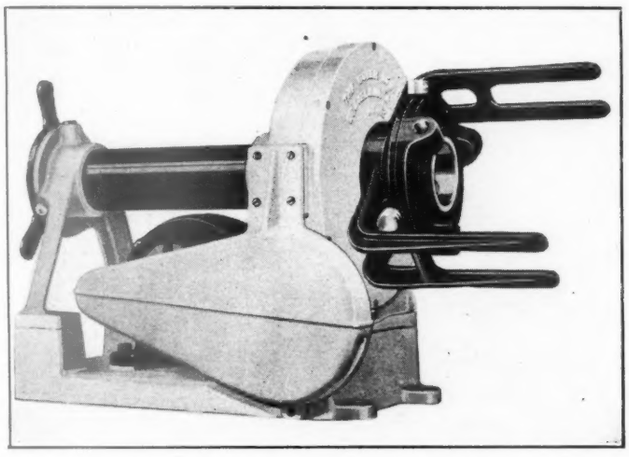
The quick withdrawing device has been incorporated in the 20-in. lathe, which consists of coarse and fine threaded screws so arranged that either one may be engaged as desired by the simple tightening of one or two bolts. When engaged, the quick withdrawing device allows the tool to be completely withdrawn from the coarsest thread by a quarter of a turn of the cross feed hand wheel. In addition to this device stop and threaded nuts are provided.

The hand wheel of the compound rest is mounted at an angle to afford knuckle clearance, and to enable the micrometer dial to be more easily read.

The machine is available with three lengths of bed, with 48-in., 72-in. and 96-in. center distances, respectively. The net weight of the 48-in. machine with regular equipment is approximately 6,200 lb. without motor or electrical equipment. Additional equipment includes a taper attachment, oil pan, collets, chucks, etc.

Portable power pipe threader

THE Oster Manufacturing Company, 2057 E. 61st place, Cleveland, Ohio, has recently introduced a new and lighter weight model of its power drive for pipe tools. The body of the machine is made almost entirely of an aluminum alloy which is not only stronger and more durable than the former cast iron model but is much lighter in weight. The new machine weighs only 150 lb. and is portable without removing any parts.



Oster Power Boy pipe threading and fitting machine

The driving power is furnished by a ½-hp. universal, reversible motor which automatically speeds up on the smaller sizes of pipe and holds the necessary speed on the larger sizes, giving the outfit a greater production capacity. The universal motor can be run from any 110 or 115-volt lighting circuit either direct current or alternating current, single phase and of any frequency from 25 to 60 cycles. Its reversible feature makes it possible to use nearly any die stock in connection with the machine.

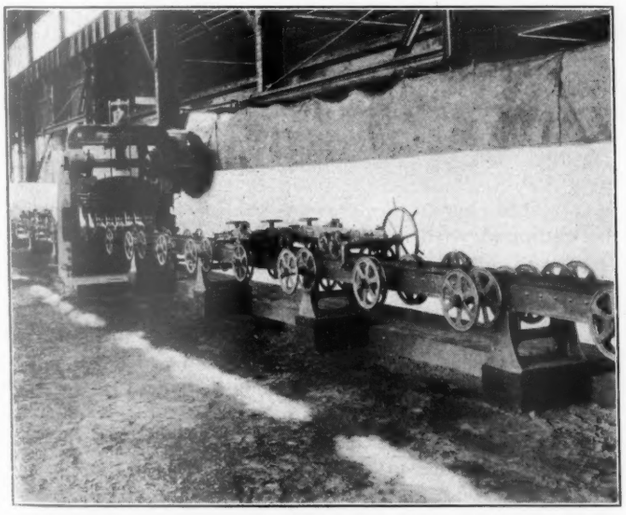
The machine itself will drive die stocks and pipe cutters up to 2 in. capacity but with a special auxiliary drive shaft geared die stocks and cutters up to 6 in. capacity can be driven. In addition to this the machine can be used to screw up fittings, as a pipe wrench can be held in its driving arms and revolved.

The pipe is held stationary in a three-jaw self-centering chuck and the pipe tools are turned by the driving arms. Self-centering universal guides in the rear of the machine assist the front chuck in centering long pieces of pipe.

An idea of the compactness of the machine can be gained from the fact that it is only 18⅛ in. high, 14½ in. wide and 30 1/6 in. long.

Spacing table for punching machines

IMPROVED and simplified features are embodied in the hand operated spacing table recently placed on the market by the Stiening Spacing Machine Company, 1016 Empire Building, Pittsburgh, Pa. The machine, as illustrated, is of the triple pass type, used in connection with a large multiple punch and arranged to handle plates, angles, beams, columns and other structural shapes for web punching. One pass of the table may be arranged with adjustable rollers thereby allowing the table to be used both for web and flange punching. As there is no direct connection between the table and punch, this table can be used with a punch already installed.



Hand operated spacing table for punching plates, angles, etc.

The template on this machine is of the permanent type, made of high carbon steel and arranged to accommodate hardened steel pins. The set-up is accomplished by inserting the template pins at the required spaces. This arrangement makes possible a very quick set-up and eliminates the necessity of making a separate template for each particular job. This allows the machine to be effectively used even when only a few duplicate pieces are to be punched. The template arrangement is such that fractional spacings of sixteenths may be obtained.

The material after being loaded on the trailer table is gripped by means of quick acting gripper carried on the spacing carriage. The arrangement of this gripping device allows holes to be punched close to the end of the material. The trailer carriage is equipped with a lever operated gripper which releases near the end of the spacing and is only used when punching plates. Other materials are gaged at the punch and need not be held by a trailer gripper. A centering device is provided which quickly centers the plates before they are gripped.

The spacing carriage which feeds the material, is manually controlled by the operator, who propels it by means of a large handwheel. The travel of the carriage is arrested against the template pins, thus assuring positive, accurate spacing. After the punching operation the operator disengages the template dog by means of lever located near the handwheel and then feeds the material until the dog engages the next template pin. The spacing carriage is equipped with a multiple number of template dogs which allow for an entirely different series of set-ups to be made on the template at the same time. This feature makes possible the complete punching of an angle, having different spacing of the holes in the two legs, without removing the angle from the table or without resetting the template. In this manner the necessary handling of the material is reduced to a minimum.

Improved locomotive tire boring mill

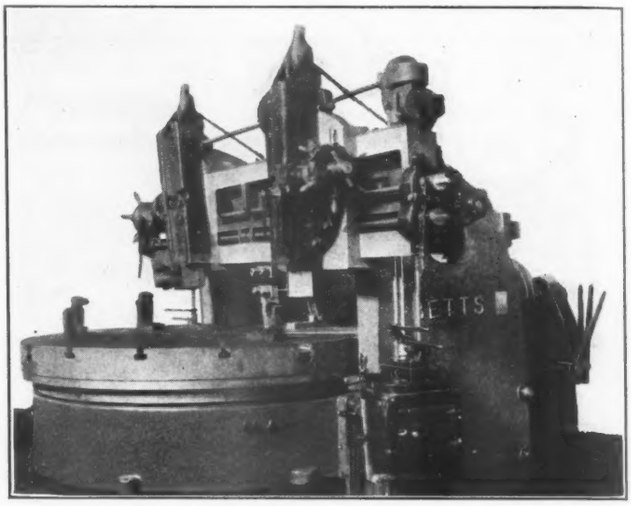
AN improved design of vertical tire mill for boring and turning steel locomotive tires has recently been developed by the Betts Works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y. The illustration shows a 90-in. machine which has a swing of 100 in. Machines of similar design have been built in 66-in., 72-in., 84-in., 96-in. and 108-in. sizes.

Compared with Betts tire mills of earlier design, it will be noted that this machine has a narrow guide crossrail, power rapid traverse to the saddles and the tool spindles driven by independent motors. It has a continuous feed with eight changes through sliding gears and speed change gears fully enclosed and running in oil. The speed change gear box is built into the bed at the rear of the machine between the uprights.

The table is equipped with a four-jaw universal chuck for centering the tires. The application of a wrench at any one of the jaws causes all the jaws to move inward, thereby automatically centering the work. Each jaw is provided with a special eccentric hold-down clamp for use when boring. The clamps are tilted backward readily to permit the removal of the tire. Special heavy-duty clamps are used in connection with the universal chuck for withstanding the thrust of the form tools in turning the treads.

This machine is designed for heavy duty. All the driving and feed gears, as well as the saddles and tool spindles are made of steel. The tool spindles are of extra heavy rectangular section and are carried in swivels provided with square guides throughout.

The crossrail has a wide face and no vertical adjustment. Machines of similar design are built with a movable crossrail for shops requiring more room under the tools. The feed and power rapid traverse may be engaged, disengaged and the direction reversed by means of two levers located conveniently just above each feed box.

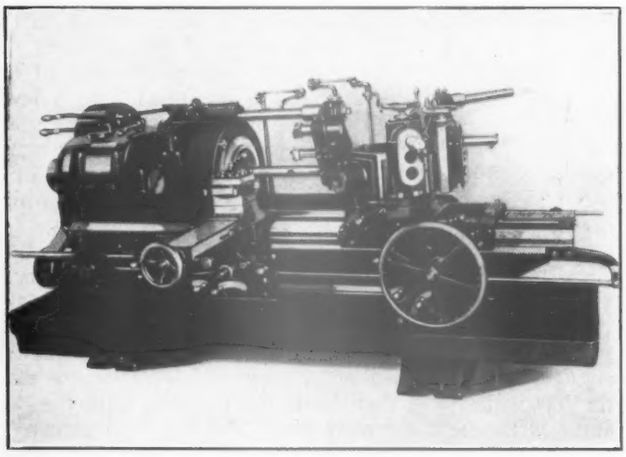


Betts 96-in. tire boring mill which has a swing of 100 in.

The table is of unusual depth and is driven by steel internal gears of large diameter, wide face and coarse pitch. Alemite lubrication is used for the main bearings.

Protected ways a feature of new turret lathe

AN enlarged No. 3-A turret lathe has recently been announced by the Warner & Swasey Company, 5701 Carnegie avenue, Cleveland, Ohio, in which greater driving power and rigidity have been embodied.



Complete tool equipment is provided for bar and chuck work—The machine is shown here tooled for chucking operations

This machine also incorporates an improvement in turret lathe design which is of more than usual interest—a method for protecting the ways from grit, chips or cutting lubricant. In this way the alinement of a recently purchased machine, an indispensable feature for accurate work, is maintained in harmony with the performance of other machine members. All the advantages of the present 3-A turret lathe are retained and the design permits the taking of cuts from the hexagon turret and the square turret at the same time. In addition, the tooling provides for multiple cuts from each turret station, and the proper rigidity for supporting such cuts with heavy feeds. The new 3-A machine is universal for either bar or chucking work. On chucking operations the machine will regularly be equipped with a 22-in. chuck. The maximum swing over way covers is 25¼ in., and the square turret carriage clears a diameter of 18 in. The hexagon turret carriage has a maximum longitudinal travel of 48 in., while the square turret has a cross travel of 12¾ in. For bar work the machine has a capacity through the chuck for 7½-in. round bars, with a maximum turning length of 39 in.

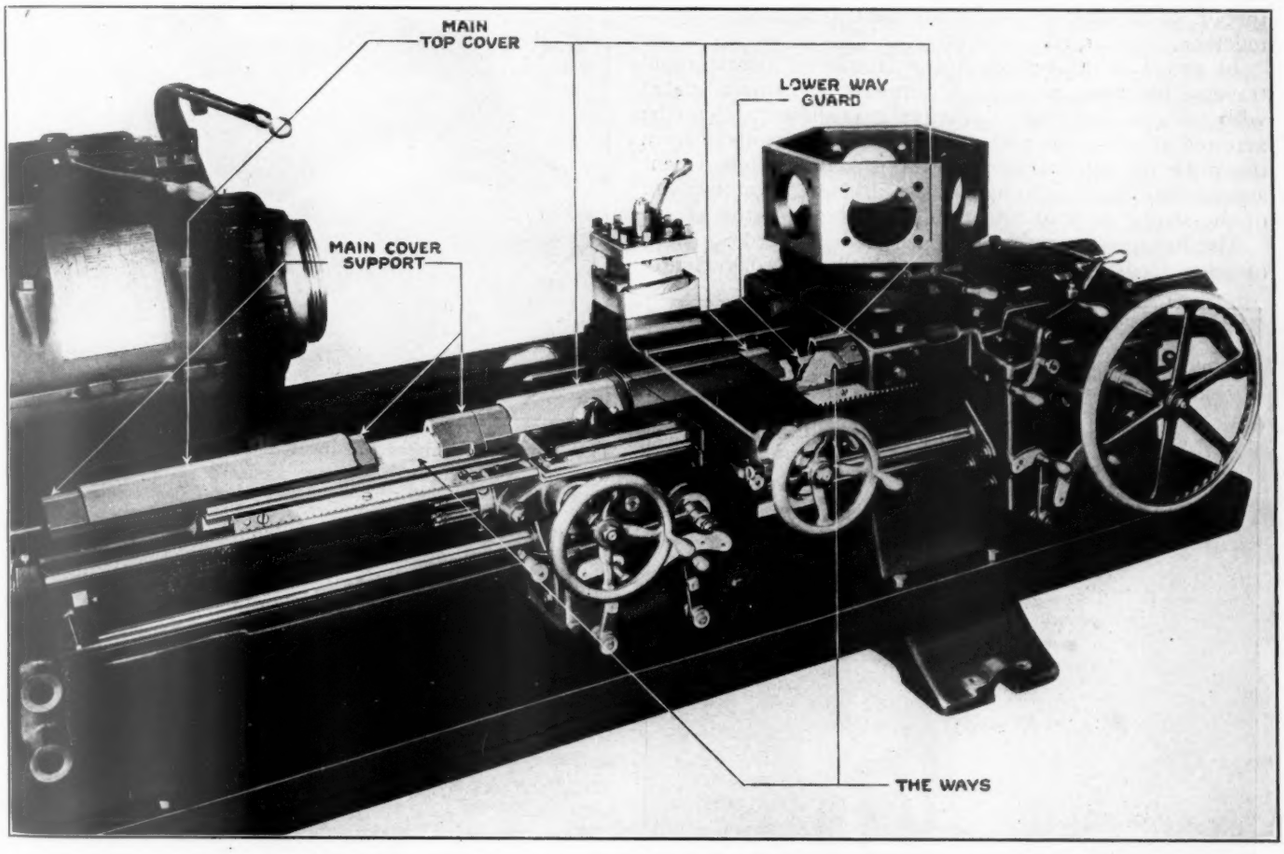
The new patented way covers completely enclose the ways of the bed. All of the ways of the machine are covered, regardless of the simultaneous operation of the hexagon turret and the square turret in different positions along the bed. Grit, chips and cutting lubricant are prevented from reaching the surface of the ways, and wear from the continual dropping of chuck wrenches or tools is avoided. The construction of the way covers is shown in one of the illustrations. The pressed steel main top cover runs the entire length of the ways, passing through an inverted vee slot in the square turret carriage. The main top cover is fastened to the hexagon turret saddle, thus moving independently of the square turret carriage. The left, or

free end, of the main top cover, is supported by the main cover support, a heavy cast iron member attached to the square turret carriage and moving with it. This support provides solid metal between the main top cover and the ways, so that heavy chucks may be mounted or heavy work gripped without damaging the way covers. In order to prevent any chips from working up underneath the main top cover in the space between the hexagon turret saddle and the side carriage, a lower way guard is provided. This guard is attached to the right side of the square turret carriage, moving with it, and passing into a slot in the hexagon turret saddle. The rear way at the back of the machine is protected by a heavy rolled cover which rests directly on the ways and passes through a tunnel at the back of the all geared head. Two shorter covers are also added at the back of the hexagon turret saddle to prevent chips from dropping off the tools onto the rear ways. To provide a reliable method of lubrication when the ways are enclosed, the square turret is fitted with an oil plunger pump which can be easily filled from an ordinary oil can. Oil is thus fed by pressure onto the ways of the machine. Oil is also provided for lubricating the hexagon turret ways.

The head of the machine is cast in one piece with the bed which is typical of other Warner & Swasey machines. The all-geared head is designed to produce ample power through a series of broad-faced, hardened and heat-treated alloy steel gears. These run in oil, and can absorb a maximum in-put of 25 hp., although a 10, 15 or 20-hp. motor may be used for the average range of light to heavy work. While flood lubricant is provided for the entire head, the main spindle bearings are constantly supplied with clean oil from oil cups. Twelve spindle speeds, both forward and reverse, are instantly available.

Another new feature is that the front and back shafts and also the drive shaft run in taper roller bearings with adjustment for end play. This construction makes possible a narrower arrangement of the head in the front and rear, so that the cap bolts of both spindle bearings are readily accessible. The use of taper roller bearings also increases the power efficiency, so that a greater proportion of the total power in-put of the machine can be used for actual cutting purposes.

The spindle is machined from a solid hammered billet by drilling out the core, in accordance with the established Warner & Swasey custom. The material is a hard, wear, resisting steel and the spindle is ground on all outside diameters over the bar into gear diameters. The spindle nose is of an entirely new type. It is threaded for fastening the chuck securely onto the spindle, but the pilot is tapered instead of straight. This gives a taper bearing for alinement for mounting chucks or fixtures, and is extremely rigid. In case of wear, it is possible to dress up the taper and the front shoulder to a new and accurate fit at any time throughout the life of the machine.



Phantom view of the way covers on the Warner & Swasey enlarged 3-A turret lathe

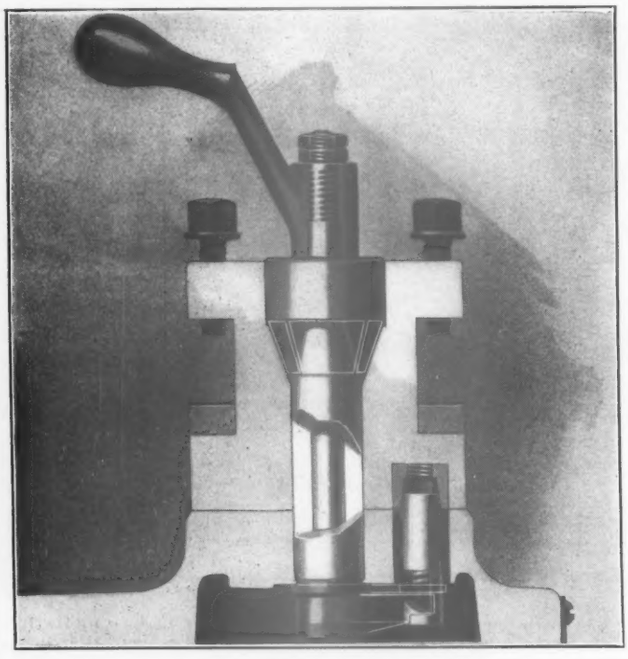
Because of the power developed in the head of the machine and the necessity for absorbing the maximum torque, the head, is cast solid with the bed. The square turret carriage is anchored to a third rail or guide at the lower front of the bed. Thus the cross slide does not have to reach across the ways for rigid anchoring, and the spindle, the hexagon turret, and the square turret can all be brought close to the bed without sacrificing the maximum swing over the square turret carriage. This design also permits the square turret to be run out of the way to the extreme left and past the chuck when chuck and work are less than 18 in. in diameter.

The turret is of the heavy hollow hexagon type with

broad faces to which the tools and holders are bolted from the inside. Aside from the structural strength of this box type of turret, assurance of the accurate alinement for center piloted or overhead piloted bars and other tools is given by means of projecting bosses which enter large holes in the turret faces. The turret is mounted on a heavy saddle which has its bearing directly on the ways of the bed. A vertical lock bolt, located immediately under the working tool, locks the turret accurately in any of its six positions. The center pivot stud is tapered and cast solid with the turret. It fits into an adjustable tapered bushing in the saddle so that accurate alinement can always be maintained. To provide accurate alinement for heavy duty work, the turret is clamped to its seat by an outside split ring binding mechanism, which is a patented feature. This ring has a double taper which hugs the tapers on the saddle and turret respectively. A single lever is employed for operating the ring through a right and left hand thread. This arrangement binds the two members solidly together.

In order to lessen operating fatigue, a power rapid traverse has been provided for moving the turret loaded with tools to and from its working position. It can be arrested at any point, and on the return stroke away from the work the rapid traverse lever is kept in engagement automatically and is automatically disengaged at the end of the stroke without attention from the operator.

The hexagon turret is equipped with 16 feeds. Eight of these feeds are readily obtained by levers conveniently



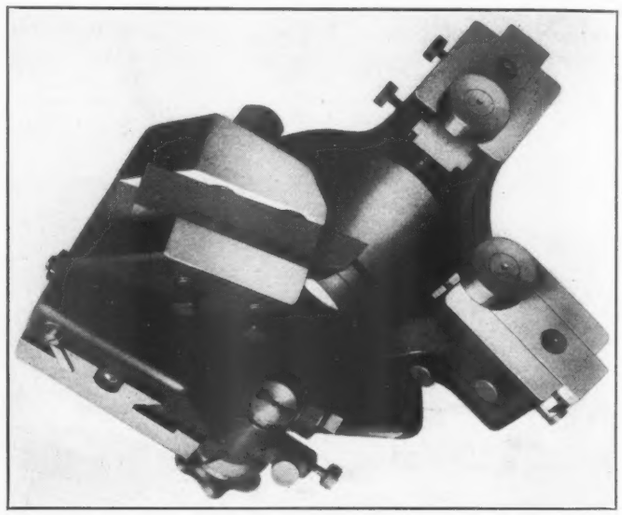
The square turret may be clamped in any position by a quarter turn of the binder handle

located in the turret apron itself. An additional lever operates a doubling gear located in the gear box at the head end of the machine, thereby making available a selection of 16 feeds from .005 in. to .167 in. per revolution of the spindle, for any kind of work which comes within the range of the machine.

The turret feed is engaged and may be reversed by levers also contained in the saddle apron. The feeds are automatically and accurately disengaged by adjustable stops on the roll. This is located between the V's. The stops can be quickly and accurately set, an important feature for small lot work.

The square turret, which is mounted on the carriage, will hold four or more forged tools. The turret is indexed without being lifted from its seat, and can be clamped in any position by a quarter turn of the binder handle. The narrow construction of the turret allows the hexagon turret to come close to the work without danger of interference, and thus turning cuts, even in close quarters, can be taken by the hexagon turret, leaving the square turret free for the facing cuts. This permits a wide application of the principle of combined cuts.

The new arrangement for feeds provides 16 longitudinal and 16 cross feeds for the carriage. These may be operated either forward or reverse. With the wide



The universal turners are provided with large dials having graduations for accurate sizing

range of feeds, peripheral turning, cross facing or recessing operations may be performed by the square turret tools while the hexagon turret is engaged in drilling, boring or turning cuts. The longitudinal feed to the carriage may be accurately and automatically disengaged by six adjustable stop screws which are mounted on a revolving spool in the apron. To assist the operator in cross feeding, a large dial is mounted on the screw near the handwheel for accurately gaging the depth of the cut. This dial is graduated in thousandths, and numbered metal clips are provided for securing accurate repetition of the settings.

For bar work this machine is fitted with a three-jaw chuck, ratchet bar feed with work support, two universal turners, pointing or chamfering tool, tool holders and a three-in. automatic die head.

The equipment for the new 3-A is so designed that full advantage may be taken of the principles of combined cuts, multiple cuts and rigid tooling. Overhead piloting is regularly provided. The overhead pilot set of chucking equipment consists of a three-jaw, extra heavy chuck, a multiple turning head, two slide tools, one short and one long flanged tool holder, one multiple turning head, two center pilot boring bars with boring heads, and two center pilot bars and spindle bushing.

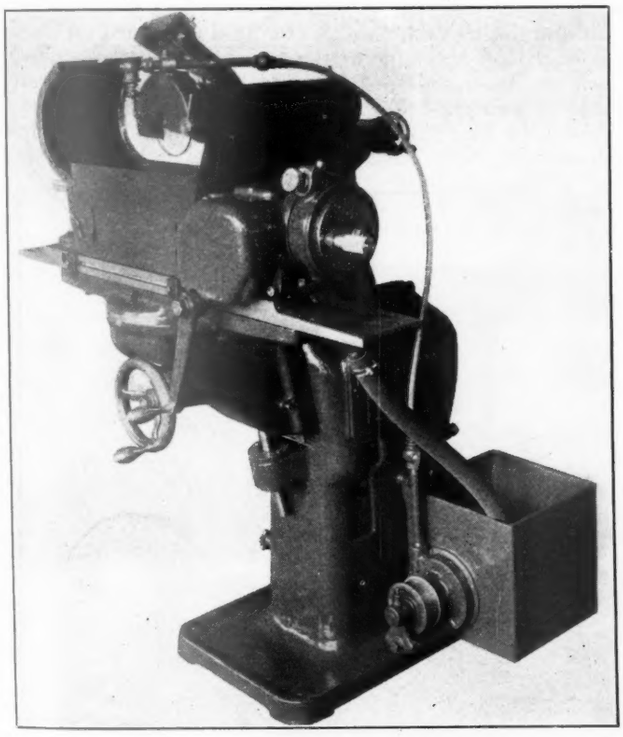
A taper attachment may be mounted on the base located at the front of the carriage beneath the cross slide. The attachment consists of a slide with an adjustable swivel plate which guides a hardened and ground block pivoted directly under the nut of the cross slide screw. The attachment may be readily withdrawn when not in use. Tapers 12 in. long can be turned up to 1½ in. per foot

(an angle of 3 deg. 35 min. with the center-line, or 7 deg. 10 min. included angle). By means of a special plate, tapers 6 in. long can be turned up to 3 in. per foot (an angle of 7 deg. 8 min. with the center line, or 14 deg. 15 min. included angle). Either type of taper attachment may be used.

Hob and cutter grinder for the tool room

THE Pratt & Whitney Company, Hartford, Conn., division of Niles-Bement-Pond Company, New York, has recently introduced a new hob and cutter grinder, which is designed for general use in sharpening gear hobs, thread hobs, form milling cutters, Pratt & Whitney "curvex" cutters, and for sharpening any cutter which must be ground in the flutes.

The grinder is motor driven with the motor mounted inside the column on a hinged platform. A belt drives a pulley on the wheel spindle which provides a smooth drive necessary for grinding. The hinged platform, on which the motor is mounted, has a screw adjustment for regulating the tension of the belt. A ¾-hp. motor with a 1¼-in. belt is sufficient for ordinary sizes of cutters, but in cases where it is necessary to sharpen the cutters of large diam-



Grinder designed for general use in sharpening gear hobs, thread hobs, form milling cutters, etc.

eters having deep gashes, a 1-hp. motor with a 2-in. belt is recommended. Mounting the motor in this manner has several advantages, in that it is kept free from dust and dirt but at the same time is well ventilated. It is set low enough to avoid vibration.

The column of this machine is a single casting which provides a rigid construction. It carries the knee on a dovetail slide at the front, the top surface of which is machined for mounting the wheel slide. The wheel head is mounted on the top of the column casting, as shown in the illustration. A hand wheel for traversing the grinding wheel is located on the rear of the slide, conveniently for the operator. A graduated dial on this hand wheel permits accurate setting. The grinding wheel spindle is mounted on ball bearings and provision is made for adjustment of end thrust. All bearings are protected by felt washers to prevent possible injury from grinding dust. The grinding wheel is trued to an angle which enables it to clear itself when it is used for grinding in a spiral fluted cutter.

The face of the knee slide is at an angle of 12 deg. from the vertical in order to correspond with the cone angle of the grinding wheel. Elevation of the knee is controlled by an elevating screw operated by a large hand wheel located in front of the machine. This hand wheel is connected to the elevating mechanism through a pair of bevel gears. A binder is provided for holding the knee in position.

The table is arranged to pivot on the top of the knee so that it may be swung to any angle with the wheel spindle, in order to compensate for the helix angle of the cutter being ground. A rack and pinion driven by a hand lever is used to traverse the table longitudinally. Stops are provided to control the table movement. The tailstock is mounted in a tee slide in the table so that it may be adjusted for various lengths of cutters. The tailstock spindle is of heavy construction and is held in position by a binder.

The same pinion which meshes with the table rack also meshes with the gearing within the index head, which produces the necessary rotary motion when grinding spiral flutes. A system of change gears provides for all leads varying from 3 in. to 133⅓ in. Movement is taken from the change gears to the spindle through a pair of bevel gears. On the rear of the spindle is a large helical spring to eliminate back lash in the mechanism.

Turning a small knob on the top of the index head rotates the head spindle through a small arc sufficient to pick up a flute with the grinding wheel. A lock pin is placed on the rear of the index head by means of which the spindle may be locked in position when it is desired to grind straight flutes. When grinding straight flutes, it is necessary to take out the change gears so that there is no connection between the index head spindle and the table driving rack. The nose of the spindle is equipped with a suitable driving dog. Indexing is accomplished by index plates, shown in the illustration, on the rear of the indexing heads. The plates are of the type that is provided with holes, similar to those generally used on a universal milling machine.

This machine is equipped with a truing device, which is shown in the illustration, pivoted on the side of the column. It is mounted on a swinging bracket which can be swung back out of the way while the grinding wheel is being used. When it is desired to true the wheel, the wheel guard is raised and the truing device is lowered into position where it is held in exact location by a pin. A regular truing diamond bar is used and pins on the truing slide provide locating points for obtaining the exact angle on the wheel. The truing slide may be rotated through a short arc to obtain an exact setting by means of a setting gage which is provided with the machine.

Ordinarily this machine is used as a dry grinder. It may be arranged, however, for wet grinding by adding a water tank to the side of the column and equipping the

machine with a pump which can be driven by the same motor that drives the grinding wheel. Suitable water guards for the table are available together with the necessary troughs for returning the water to the tank. This grinder occupies a floor space of 58 in. by 40 in. and is 51 in. high.

Gasket and joint cement and rust solvent

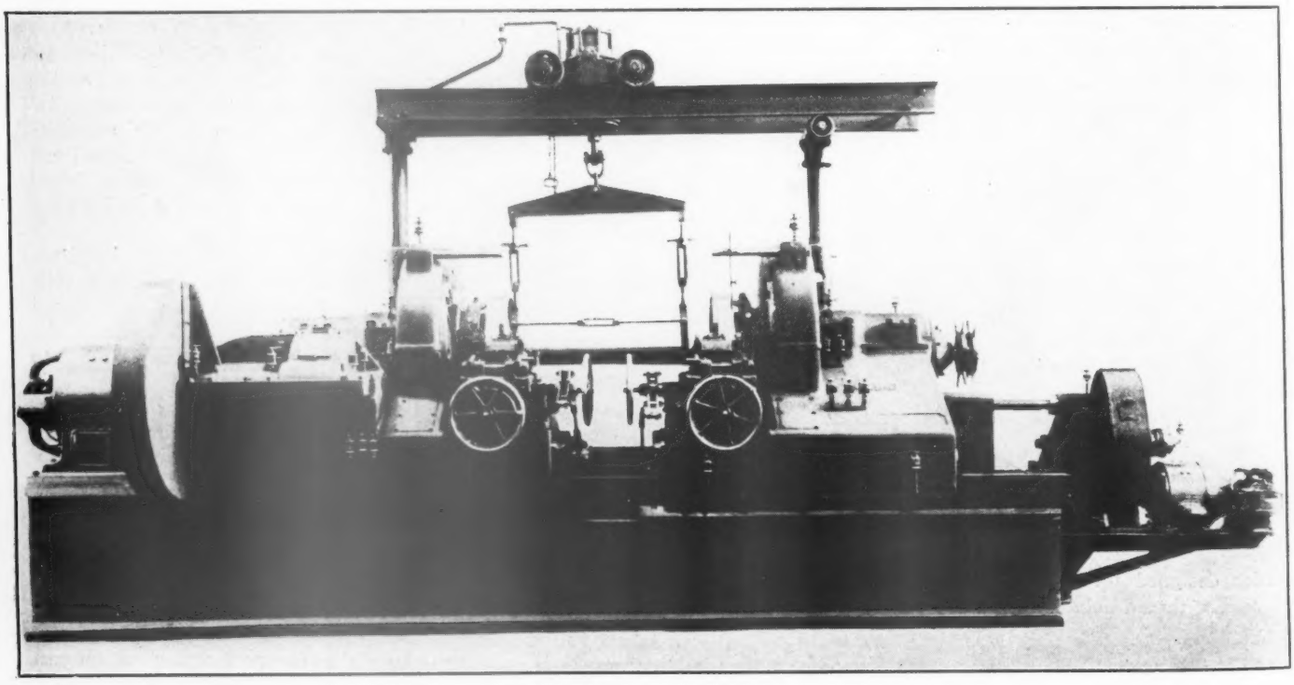
IT is often necessary when repairing machine tool equipment to make gaskets tight or stop oil leaks in a lubricating system. Plasgon plastic gasket and joint cement, manufactured by the Polygon Products Company, 141 Milk street, Boston, Mass., is used for the above purpose. It is oil, acid and water proof, sets quickly and solidly and does not crack or disintegrate. It is squeezed out of the tube in which it comes and is spread on with a small wood paddle to form any shape of gasket required. It can also be used for making tight joints on pipes, handhole plates, valve bonnets, leaky flanges, bolts, studs, etc.

Another product of this company is Tasgon, a rust solvent, which is used for loosening up tight joints or connections. A few drops of Tasgon on a rusty nut, bolt or threaded joint are said to dissolve the corrosion and help make the disconnection easy. It is said not to injure metal.

Wheel turning lathe for car wheels

THE car wheel lathe shown in the accompanying illustration is essentially the same in general design and proportions as those machines previously built by William Sellers & Co., Inc., 1600 Hamilton street, Philadelphia, Pa. Improvements have been made, however, to simplify the manipulation so that the least possible time and labor should be required for handling and settling the work and for bringing the necessary tools into successive operation; to take the heaviest cuts with the highest speeds that new tool steel will permit; to turn all kinds of steel car wheels, or car wheels with steel tires from 28 in. to 42 in. in diameter, whether they be of plate, arm, or composite construction, without requiring any holes or openings in the wheels for bolts or drivers; to provide for axles with inside, as well as outside journals, and to accommodate axles with driving gears or armatures between the wheels.

The method of supporting the movable head on the bed is novel. There is no bearing between the top of the shear and the movable head. The head is carried on steel bars bolted on each side of the bed, forming tracks upon which the head slides. The slide bearings on the head consist of two removable shoes which rest on these bars. Taper shoes are provided between the head shoes and the underside of the overhanging lathe shear, which may be adjusted to eliminate excessive lost motion between the bed and the head. This arrangement protects the bearing surfaces from chips and dirt by the overhang of the top shear, and it has the additional advantage that all parts which may become worn in heavy service can be removed and replaned without dismantling the lathe.



Sellers 42-in. car wheel lathe

The gearing from the motor to the faceplates is heavy. Two sets of herringbone gears are included in the train, which help to give smooth action and a good finish to the

wheels. All bearings are bronze bushed and all pinions except the motor pinion are supported with bearings on both sides.

The right-hand head is adjusted by a motor mounted at the extreme right-hand end of the machine. The motor drives a screw through a slip clutch, which protects the gearing and limits the initial pressure applied to the drivers. A solenoid brake, which holds the mechanism whenever the power is turned off the motor, serves to clamp the head securely in position. This automatic clamping eliminates one detail which the operator of the machine or his helper usually has to take care of. He is thus relieved of work and of the danger of forgetting to clamp the head, with its attendant possibility of damage to the machine.

Each faceplate is provided with three self-tightening drivers. Each consists of a stand bolted to the faceplate, with bolts sliding in slots. They are thus adjustable for wheels of various sizes. The driving arm has trunnions carried in this stand, and is provided with a serrated bit and cam, both of hardened tool steel. The function of the bit is to grip the wheel to turn it. In case the wheel starts to slip, the cam at the other end of the driver will move in such a way that it will force out the long end of the driving arm from the wheel, thus putting more pressure on the bit. In this manner the pressure of the cut will tighten the drivers and automatically prevent any further slipping.

The drivers are brought in contact with the wheel when the movable head is slid into place, and as all the drivers bear equally upon the wheel the tendency to distort the wheels or axle is entirely eliminated. The tool posts are each an integral part of their respective heads, thus the tool maintains a fixed relation to the faceplate irrespective of the gage of the wheels being turned, and a considerable amount of adjustment is eliminated.

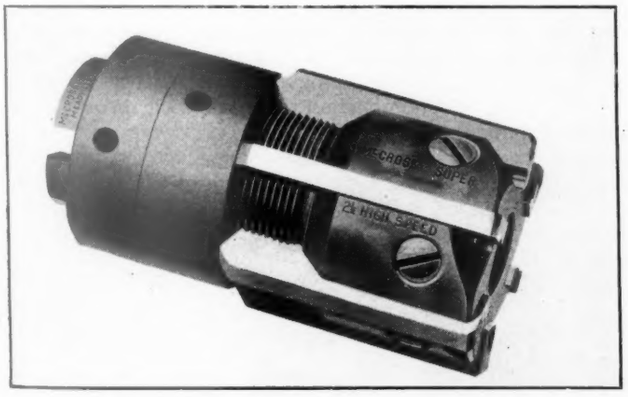
The turret is made of vanadium steel and so designed as to require the least possible projection of the tools. Should the roughing tool require changing during an operation, it may be removed from the back of the turret and replaced without stopping the lathe or without revolving the turret.

The slides are provided with heavy steel shoes, hardened and ground on the surfaces that are exposed to dirt and chips. Adjustments for wear are provided.

Four tools for each turret are required for the entire operation of turning a wheel. These are arranged in the order of their use, one on each side of the turret. A partial turn of the wrench is sufficient to tighten or release the turret, which may readily be turned when free. When the proper tool is opposite the work, a double cam stop is laid over behind the turret, rigidly clamping it.

An adjustable reamer and a lathe turret

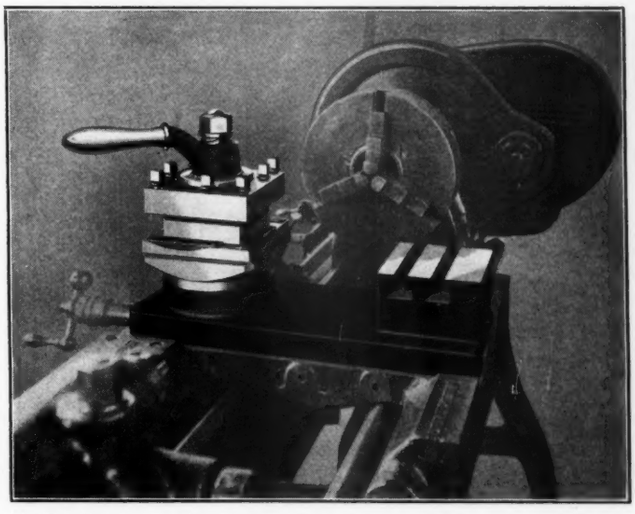
AMONG the new tools which have recently been added to those manufactured by the McCrosky Tool Company, Meadville, Pa., are an adjustable reamer and a turret for use on engine lathes. One of the features of the reamer, known as the McCrosky Super reamer is



The blades of this reamer may be reground from 10 to 20 times

the method of locking the adjustable blades. A key, made of drill rod, holds each blade in its slot and the key in turn is gripped by a hardened steel headless set-screw. In order to provide clearance and support, the reamer body has been relieved in front of the cutting edge of each blade to provide ample space for chip clearance and lubrication. In addition to minimizing the possibility of chips clogging along the cutting edge of the blades this clearance makes it possible to shorten the projection of the blades over the end of the reamer body. Adjustment of the blade is made forward to increase the diameter in such a manner that the bottoming feature is continually maintained and the cutting end of the blades is always slightly in advance of the reamer body. Sufficient stock has been left so that by radial regrinding a total adjustment range of .125 in. is secured which makes possible from 10 to 20 regrindings for each set of blades. Only six sizes of blades are required to fit all sizes of these shell and chucking reamers from 15/16 in. to 14 in. diameter.

The turret for engine lathes provides a means for materially increasing the range of work which it is possible to perform on an engine lathe. These turrets are made in nine sizes of square, round and hexagon types; the square turret being shown in the illustration. The



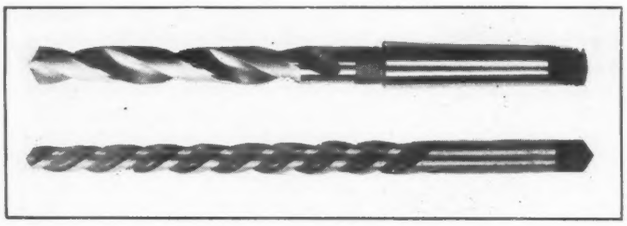
McCrosky square turret mounted on special cross slide for multiple tool set-ups

indexing feature consists of the revolving body which has a corrugated bearing surface on its under side which meshes into similar corrugations on the stationary base. Releasing the clamping handle a half turn raises the turret body clear of these corrugations, permitting the turret

to be swung to any of the 12 indexing positions. Thus a three-tool turret has four positions available for each tool desired; a four-tool turret, three positions and a six-tool turret, two positions. The illustration shows a square type turret mounted on a special cross slide for multiple tool set-ups.

Forged type drill and taper pin reamer

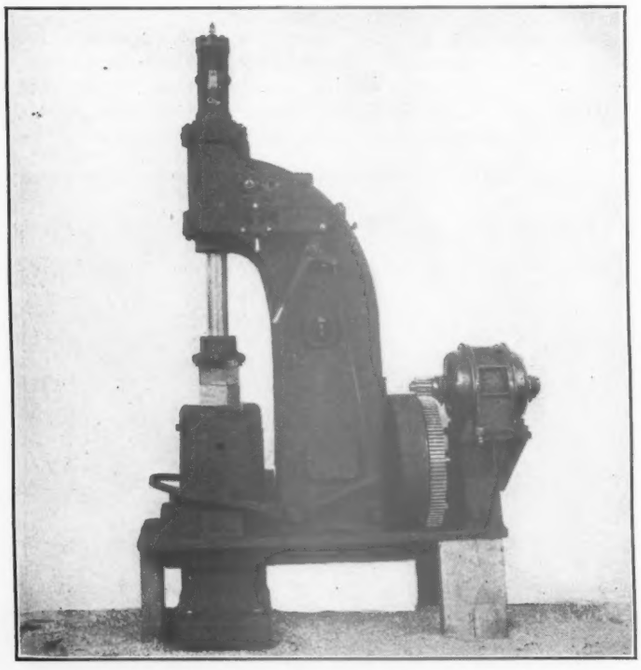
REALIZING the demand for a rugged, sturdy drill of the forged type, the Morse Twist Drill & Machine Company, New Bedford, Mass., has developed a forged type drill of the type shown in the illustration. These drills are furnished in sizes ranging from 5/16 in. to 2 in. This company has also added to its line of drills and reamers a three-flute taper pin reamer. This reamer was submitted to the Tinius Olsen Testing Machine Company, Philadelphia, Pa., for comparative tests with reamers of the three-flute left-hand spiral and straight flute types. These tests were made at the same time in machine steel 1½ in. long, feeding the reamers through 2½-in. penetration. The results of these tests showed that the three-flute left-hand spiral reamer broke under a force of 5½ in.-lb., the straight flute reamer broke at 34 in.-lb., and the three-flute right-hand spiral reamer, broke at 55 in.-lb. The design of the new taper pin reamer provides for free cutting action and clears itself readily of chips, which makes it especially adaptable for production work.



Top—Morse high speed forged type drill; Bottom—Tapper pin reamer

Bates air-operated hammer

THE Bates air-operated hammer built by Williams, White & Company, Moline, Ill., is featured by instant response to the treadle. Light, medium or hard blows are obtainable at will and with consistent regularity. The operator can stand close to the anvil and there is an unobstructed view of the work as well as of the ram and dies, so that the hammer can be manipulated with the greatest precision.



Bates air operated hammer

When the treadle is released, the ram lifts to the upper end of the stroke and is held suspended so long as the compressor continues running in the idling position. The downward stroke of the ram is produced by the compressed air injected into the upper end of the ram cylinder. The force of the blow is augmented by the vacuum created underneath the ram piston, as well as by the compression produced in the top of the compression chamber by the previous upward stroke of the ram. A relief valve is also provided with a hand lever by which the compressor may be opened instantly in case the hammer is to remain idle for a short time. If the hammer is not to be used for a longer period, the motor is cut off or the belt thrown onto the loose pulley.

These hammers are practically constructed for maximum convenience of access and operation. There are a minimum number of parts. There is only one controlling valve, of the roatry type. The frame and the base of the hammer are cast in one piece, eliminating joints. The lower die bolster or cap is made of steel and keyed in a diagonal position to permit working long bars either way of the dies. The upper die head is securely attached to the lower end of the ram.

The ram consists of a long, solid bar, full size the entire length, and takes the full force of the blow directly. It is guided both in the upper and lower cylinder heads which are far enough apart to afford maximum length of guide as well as of stroke. No piston rod packing is necessary with this hammer. The piston head is forged integral with the body of the ram, and there is no possibility of side pressure from the piston against the cylinder. Two sides of the ram are flattened at the upper end where it passes through the cylinder head, to prevent rotation of the dies.

The back stand has a footing for the motor platform. The motor is mounted directly above the driving shaft. The drive is effected by a steel cut gear and Bakelite pinion, or by a belt with a tightener. The gear type drive is shown in the illustration.

Tight and loose pulleys are provided with the belt drive to bolt directly to the line shaft. If the loose pulley is

not desired, it may be removed and a separate countershaft, with tight and loose pulleys, provided.

The table gives the specifications for the different hammer sizes.

Weight of ram, upper die and shoe.....	100 lb.	200 lb.	300 lb.	500 lb.	800 lb.	1,200 lb.
Maximum stock, worked, square.....	2½ in.	3½ in.	4½ in.	6 in.	7 in.	8 in.
Blows per minute.....	215	195	165	140	125	115
Sizes of die surface.....	2¼ in. by 5 in.	3 in. by 7 in.	3½ in. by 8 in.	5¼ in. by 9½ in.	5½ in. by 10 in.	5¾ in. by 11 in.
Horsepower required	5	7½	10	20	30	40
Width of belt.....	3½ in.	4 in.	5 in.	6½ in.	7½ in.	8½ in.
Total weight of hammer, approx.....	4,000 lb.	6,000 lb.	9,000 lb.	17,000 lb.	28,000 lb.	32,000 lb.

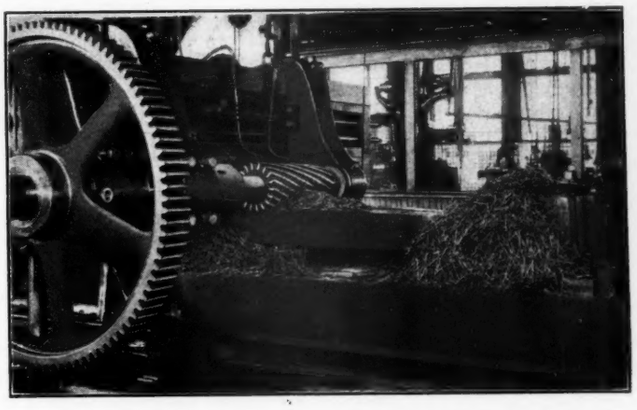
Taylor-Newbold high-speed milling cutter

THE body of the Taylor-Newbold high-speed milling cutters with inserted helical blades, manufactured by the Tabor Manufacturing Company, 6225 Tacony street, Philadelphia, Pa., is a steel forging in which under-cut helical grooves are milled. High-speed steel blades bent to conform to the back of the grooves in the body are inserted and held in place by fusible metal poured in front of the blades.

This method of holding the blades insures rigidity. After being poured the fusible metal filling is compressed, thus holding the blade firmly throughout its length.

A constant lip angle is maintained throughout, in any length of cutter; this together with the helical cutting edge reduces the tendency to chatter.

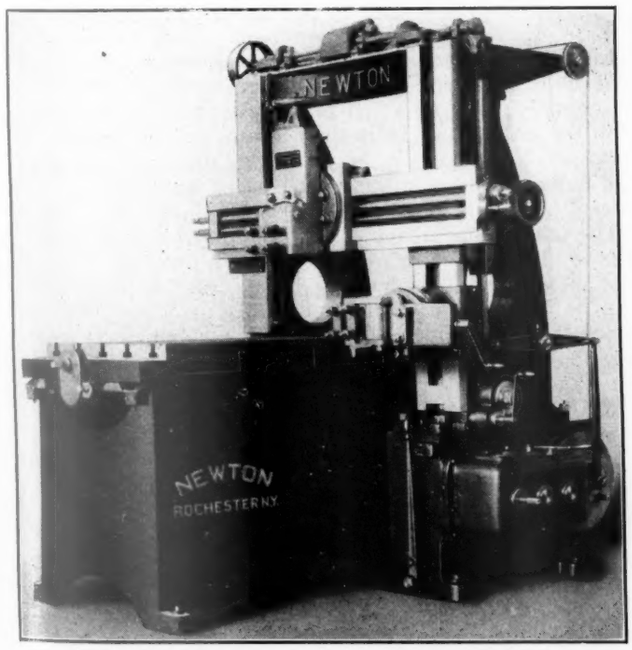
Slabbing cutters of 4 in., 6 in. and 8 in. nominal diameter are regularly carried in stock, the minimum length being not less than one diameter.



Slabbing cutter milling locomotive connecting rods

The Newton side head crank planer

THE Newton works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y., has recently developed a new side head crank planer of two sizes, one of 34-in. and the other of 39-in. stroke. This machine has, in addition to the regular rail head, an adjustable side head with vertical power feed and hand adjustment. One of these heads can be fitted to each upright if desired, thereby reducing the operating time appreciably. With the addition of one side head, production can be practically doubled.



Side head crank planer built in two sizes—34-in. and 39-in. stroke

The side head may be lowered below the top of the table when desired. It has a relief tool apron with double clamps which may be swiveled 45 deg. to either side of the zero mark. It is counterbalanced to permit easy adjustment by means of a counterweight carried to the rear of the machine and out of the way of the operator.

The table is of double plate construction with five machined tee slots and is provided with a chip pan at each end. An adjustment is available for positioning the work while the machine is stroking, which is accomplished by means of an adjustment block and screw. This block is securely clamped for the cutting operation. Six speed changes are provided, through a gear box of the sliding gear type, for changing the number of table strokes. All gears are hardened, enclosed, and run in oil. The table control is by means of a clutch and brake, permitting "jogging" for tool setting, etc. This clutch may be locked, so that the machine can not start and injure the operator.

The stroke adjustment is made from the operating side of the machine by means of a crank handle, with an indicator showing the length of the stroke in inches.

The base is a one piece casting of box type, having a closed top and provides two surface bearings for the table with side bearings and take-up gib. The uprights are also of box section and are bolted and doweled to the base and braced at the top by a deep sectional tie beam. The crossrail is adjusted by power through double lifting screws. It is of deep section and is gibbed to the uprights, to which it can be securely clamped. The tool slide in the

vertical head has equal movement above and below the bottom of the rail, thereby reducing overhang to a minimum. This head may also be swiveled 45 deg. in either direction.

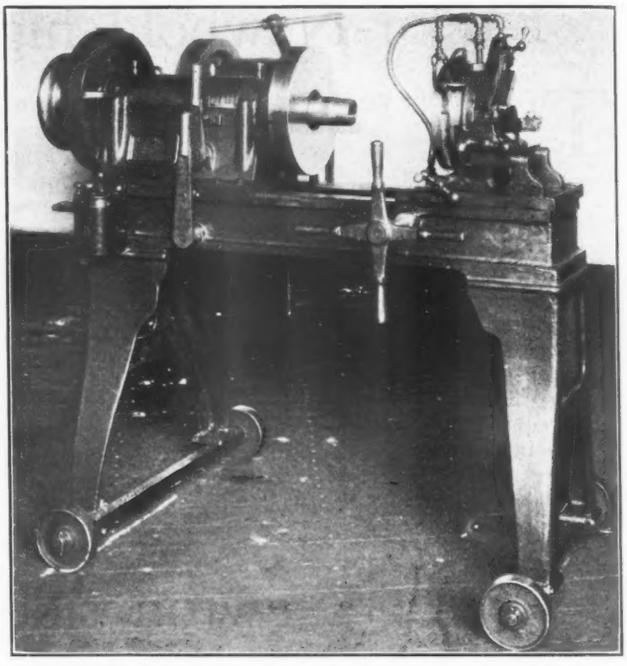
The machine can be driven by a 10-hp. 1,200-r.p.m. motor or by a single pulley through a change gear box, to a helical driving gear, the driving pinion being mounted between two bearings. This arrangement insures smooth motion. All driving bearings are bushed; essential bearings with bronze. All gears are enclosed or covered.

Portable light weight pipe threading machine

THE illustration shows a pipe threading machine recently brought out by the Jarecki Manufacturing Company, Erie, Pa., which, while of compact construction and proper weight to insure steadiness, is light enough to be easily moved from place to place. On the forward end of the spindle is a three-jaw self-centering gripping chuck which securely grips the pipe while threading. At the rear of the spindle is a three-jaw self-centering chuck for steadying long pieces of pipe while being threaded. The bore of the spindle is 4 in., which allows clearance for a 3 in. pipe with couplings attached. The dies are made of a special steel. They are milled in special machines, ground to a uniform size and tempered. The four speeds for threading different sizes of pipe are obtained by shifting the two vertical levers on the operator's side of the machine.

The machine shown may be driven by a direct connected constant speed motor or belt drive, and threads pipe ¼ in. to 3 in. with either right or left hand threads. Bolt dies ⅜ in. to 2 in. may also be used in this machine, as well as nipple holders. It is equipped with cut-off knife, swivel reaming tool and a geared oil pump.

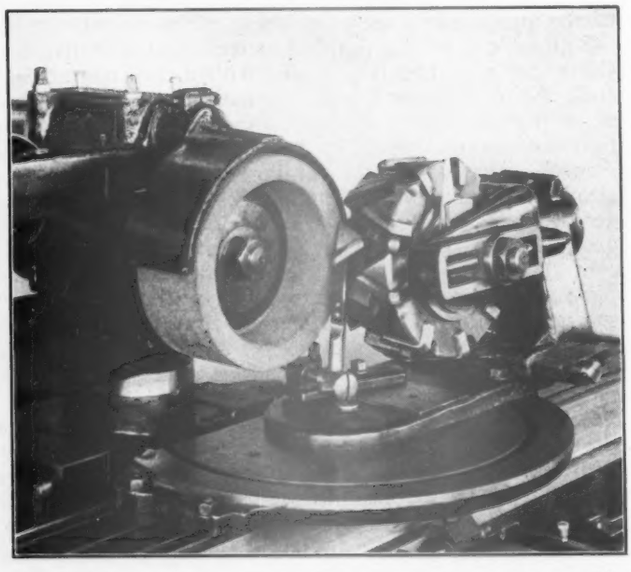
A machine of this type, owing to its capacity, can be used in the car and locomotive repair shop for pipe work, particularly airbrake pipe. It can also be used in these shops to thread bolts up to 2 in., particularly in the erecting shop where it can be wheeled up to the locomotive.



Portable machine cuts right or left-hand pipe threads

Attachment for grinding milling cutters

THE Thompson Grinder Company, Springfield, Ohio, has recently developed a radius grinding attachment designed for use with its 10-in. by 36-in. universal grinding machine. This attachment is for the purpose of sharpening the faces, sides and corners of milling cutters used in railroad shops for channeling locomotive side rods. It is so designed that the corners on the cutters may be ground to any desired radius. For cutters from 3½ in. to 10 in. in diameter, the cutter is mounted on an arbor which has a longitudinal movement by means of a screw and block sliding in a bracket. The bracket has a round shank mounted in a housing so as to obtain a rotary movement which provides any angle of clearance. This housing has a cross slide movement in its base which in turn is mounted on a plate that carries the cross slide. This plate is pivoted near one end to the center of a semi-circular sub-plate, so as to give it a rotary movement in a horizontal plane through an arc of 180 deg. The sub-plate is rigidly bolted to the main top table of the grinding machine. Small end mills may be ground by removing the bracket with the round shank from the housing and inserting directly in its place an arbor having a taper hole in its end in which to insert the shank of the end mill. All movements are graduated to either thousandths or degrees and a gage is used to give the required clearance angle.

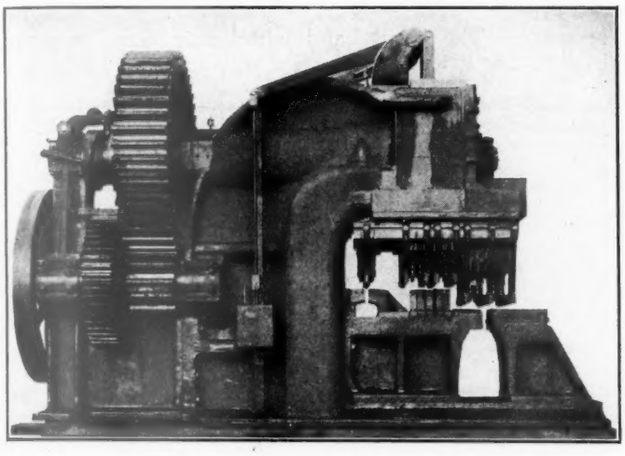


Side rod channeling cutters may be ground on the face, sides and corners

The attachment is fully universal and sufficiently flexible that the face of the cutter and the corners and one side can be ground at a single setting and the opposite side ground by taking the cutter off of the arbor and remounting with the opposite side out.

Open gap punching machine

ITS large size, the wide range of work that it will handle, and the fact that it will punch both flanges and webs without changing tools, are outstanding features of a new punching machine that has been brought out by the Cleveland Punch and Shear Works Company, Cleveland, Ohio. The capacity is for punching 8-in. to 30-in. Bethlehem girder beams in the flange and web without changing tools. Bethlehem H-beams ranging in size from 8 in. to 14 in., may be punched, and by placing an overhanger at the rear of the throat, standard 6-in. to 9-in. H-beams and standard I-beams may be punched without changing other set-ups of tools. The machine may be used also for punching plates.



A wide variety of work may be performed on this punching machine without tool changes

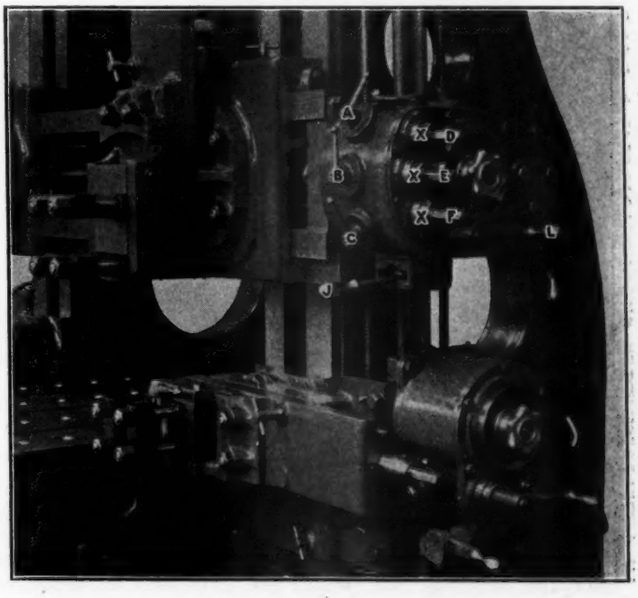
The punching tools are arranged in three standardized rows parallel to the main shaft. With the distance between the rows fixed and standardized, connecting angles can be punched with the same set-up as employed for the webs and flanges. The punching tools are adjustable from a minimum of 2¼ in. to a maximum of 48 in. The strippers are adjustable and may be set up to clear the flange and web without change. The stripper arms are attached by a single bolt. The frame is a solid casting of the I beam type of construction. The drive is of the double-gear type, and an automatic clutch of the safety type is employed to prevent a repeat stroke. The gears are of steel with cut teeth, and the jaw plate for the gears is a separate steel casting tongued and bolted on. All gears are bronze bushed. A safety feature is found in the elimination of an overhead counterweight. In its place are two counterweights, one on each side at the rear of the throat, these being guided on vertical rods.

The machine is driven by a direct-connected 40-hp. motor. The compactness of the driving end of the machine may be noted from the illustration and saving of floor space is a feature of this design. The over-all dimensions are: height, 15 ft. 3 in.; length, 15 ft. 9½ in.

Larger planer has convenient controls

ONE of the outstanding features of the 42-in. Hypro planer, recently brought out by the Cincinnati Planer Company, Cincinnati, O., is its adaptability for rapid manipulation with provision for safeguarding all movements. The general features of design on this machine are similar to one of a somewhat lesser capacity which was described in the *Railway Mechanical Engineer* for September, 1925, page 587. The illustration shows a close-up of the operator's side of the machine and gives a good idea of the convenience of the controls. Three levers, *A, B* and *C,* shown with round-knobbed handles control the direction of the head; the upper lever for the traverse of the left-hand head, the center lever for the vertical travel common to both heads and the lower for the traverse of right-hand head. These levers have three positions: in toward the planer to move both the heads down and either one or both away from the operator; up straight for neutral and no head movement, and out from the planer to move both heads up and either one or both toward the operator. The horizontal-travel lead screws, *D, E* and *F,* and the vertical-travel splined shaft project from the head and are squared so they may be operated by hand. The feed is set by the feed adjusting knob *G* and is connected when desired by turning the small feed engaging levers *X, X, X* at the base of each shaft. Safety stop levers are provided on both rail heads automatically to stop further movement at the limit of travel of the heads outward or toward each other, should the operator set them in motion and neglect to stop them himself. The straight levers *J* and *K* control the rapid motions of the rail and heads. Automatic stops further guard the rail movements at the extremes of its travel.

The detachable crank *L* just below the three square shaft ends controls a locking device between the rail and the planer housing, one turn operating a powerful toggle to pinch the clamps against the housing. This movement interlocks with the rail-lift control so that it then becomes inoperative. The lever *K* at the lower edge of the illus-

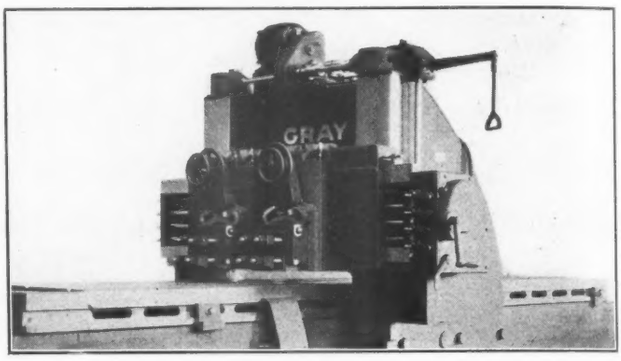


The controls are designed for rapid manipulation and the prevention of false movements

tration operates the side head lift. Thus, all movements and setting can be made from the operator's position by hand, by power feed or rapid traverse as he may elect, without fear that he may get hold of the wrong lever or forgot to bring to a stop a movement that he may have started.

Quick set apron for switch planer

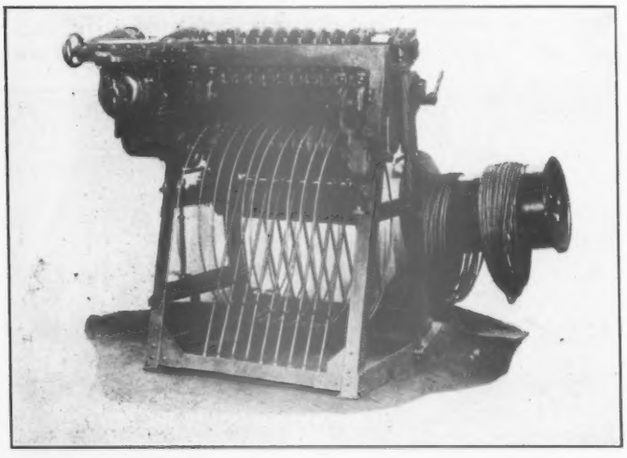
THE G. A. Gray Company, Cincinnati, Ohio, have recently made an improvement in the Gray switch planer by adding a quick set apron. The service required of this machine frequently involves changing of cuts in open hearth steel rails of 130-lb. section. The heads and the tool boxes must of necessity be of heavy rigid construction and at the same time must be capable of easy movement on the part of the operator. On this new quick set apron a double hand wheel device is provided on the front of the head. The operator first loosens the tool box by turning the large hand wheel—the small hand wheel can then be pulled out from the large one to make it more convenient to handle and when rotating, swivels the tool box to the desired angle. As a partial turn of the hand wheel gives the maximum travel of the tool box to one side or the other, the tools can be quickly swiveled to the desired angle. The operator then clamps the tool box with the large hand wheel and in the case of very heavy cuts can use a wrench on the hexagon shaped hub of the hand wheel to secure the final clamping pressure. The small hand wheel may then be pushed back so that it will not interfere with the use of long tools.



The small hand wheel controls the mechanism which swivels the tool box

Semi-hot automatic feed bolt heading machine

ABOUT five years ago the National Machinery Company, Tiffin, Ohio, started the development of the semi-hot or low temperature bolt heading machines at which time it designed and built eight machines

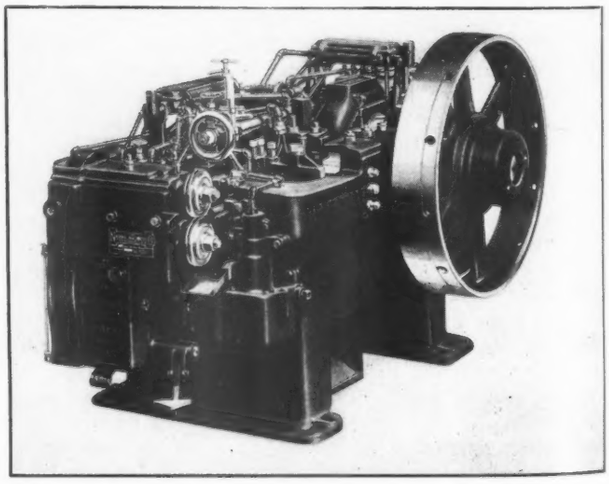


The national coiler for use with the automatic heading machines

of 1 in. rated size, described on page 187 in the March, 1923, issue of the *Railway Mechanical Engineer*, for making all classes of machine bolts. The design of the bed frame was such that spring was practically eliminated, so that it was not necessary to over-pack the grip dies or have the heading tool pound the grip dies in order to secure well filled heads, even when making semi-hot or low temperature work. Slides about twice as long as used heretofore with the National suspended type bearings were employed, and provisions made for maintaining highly accurate alinement. The feeding mechanism and shear were at an angle to the machine, and this compensated for the distortion encountered in hot shearing.

The ⅜-in. and ⅝-in. size machines were recently brought out by this company. The ⅜-in. machine makes a wide variety of single blow work, up to ⅜-in. in diameter by 4½ in. in length, by the semi-hot method. Many jobs which in a cold header require two blows and sometimes three blows, are made with but a single blow on this machine.

A long furnace with a small heating chamber is employed,



National semi-hot automatic feed rivet and bolt heading machine

and the stock is taken off the original coil and looped or rewound into coils of large diameter, by the new National coiler, shown in one of the illustrations. In conjunction

with this coiler, an electric butt welder is employed, so that one coil is joined to the other, thus providing a continuous operation. In this design single feed rolls of large diameter are used in place of the double rolls as in the larger machines.

The 5/8-in. automatic feed machine is used for making all classes of single blow bolts, rivets and upsets 5/8 in. in diameter by 7 in. in length. It has a speed range of 120 to 150 r.p.m.

The heading slide is unusual, being of greater length than the distance from the main shaft to the breast plate of the machine. This over-arm suspended type slide also has bearings back of the crank. This back bearing in reality guides the front end of the slide, and prevents the heading tool from "winking," or being thrown out of alinement when making bolts or other jobs requiring a large amount of stock.

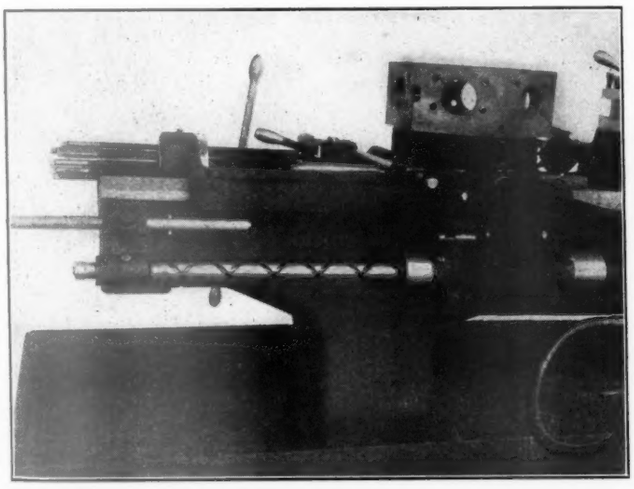
A new type of grip relief mechanism is employed, which, while providing all the gripping pressure required for the most difficult work, limits the ultimate pressure obtainable so that the working faces of the gripping dies cannot be battered and prematurely worn out.

The gripping toggles in this design are placed horizontally, as this enables extra large diameter pins to be used and yet keeps the design compact. At the same time it enables perfect lubrication, as both ends can be successfully reached by the automatic oilers.

These machines follow essentially the same features of construction and operation as the 1-in. machine previously described.

No. 1-B universal turret lathe

THE Foster Machine Company, Elkhart, Ind., has brought out a new universal turret lathe, known as No. 1-B, in which are incorporated a split ring type binder for the hexagon turret, a power rapid traverse unit for the turret slide, and a bed of increased length to effect greater longitudinal feeding movements of the carriage and the turret slide. The swing over the ways



The turret head and stops of the Foster No. 1-B universal turret lathe

and cross slide is also increased, giving greater chucking capacity than on the earlier machines of this company.

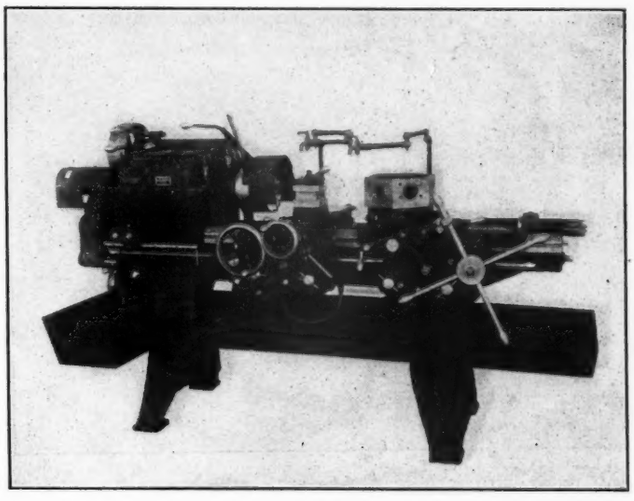
The turret binder grips almost entirely around the turret on a very large diameter. The same lever operating the turret binder releases the lock bolt.

The power rapid traverse unit is mounted on the rear of the saddle and is controlled by a lever within easy reach of the operator. The rearward movement of the rapid traverse can be automatically stopped at predetermined points. The clutches for operating this mechanism are of large diameter. The friction contact is bronze against close grained cast iron. Through an interlocking mechanism the turnstile for traveling the turret slide by hand is automatically disengaged and does not revolve under any movement, forward or back, set up by the power rapid traverse.

The cross slide extends entirely across the bed and has an effective cross travel of 10 in. It will carry a cutting tool past the center of the spindle. On the rear of the cross slide a pad is provided for mounting tools on the back side of work. The swing over the cross slide is 9½ in.

Twelve power feed changes, reversible, are obtainable for the cross movement. The longitudinal feeding movement to the carriage is 32 in. with 12 feed changes which are independent of those for the turret saddle. Six adjustable independent stops which may be indexed are provided for automatically stopping the longitudinal feeding movements of the carriage.

The turret has an effective turning movement of 32 in. and 12 feed changes, the latter independent of those for the cross slide and carriage. The lock bolt is of considerable length and located to give the greatest support to the turret face carrying the tool that is in action. The turret is of the hollow hexagon type and is tapped for independent pipe lines to each face. The independent stop screws are carried in a spool in the rear of the saddle and index in time with the turret faces. The stop screws shut



The Foster 1-B universal turret lathe equipped with a Foster-Baker automatic chuck

a slidable stop which is also adjustable and retained by a spring locking key. This eliminates the necessity of lengthy adjustments of the stop screws.

The carriage and saddle aprons are of the double plate type and all the gears therein except the worm gears, which are of hard bronze, are steel, and run in oil. The

clutches are of large diameter, adjusted from the outside.

The spindle is turned from a chromium manganeese forging. The spindle nose has a large diameter of thread, a large diameter pilot and very short overhang. The hole through the spindle is 2⅝ in. The spindle revolves in special bronze bearings. The gears in the head are machined from steel forgings, heat treated, and run in a bath of oil. Through the gear combinations effected by the movement of four levers, 12 spindle speeds are obtainable. These are reversible and range in geometrical progression from 20 to 480 r.p.m. The shafts carrying the sliding gears are of chrome nickel steel heat treated. They are splined in place of being keyed to drive the gears.

The automatic chuck is of the master collet type with a capacity of 2-in. round bars. The final closing action of the collet is effected by a toggle action. The mechanism can be supplied for either draw-in or push-out type collets.

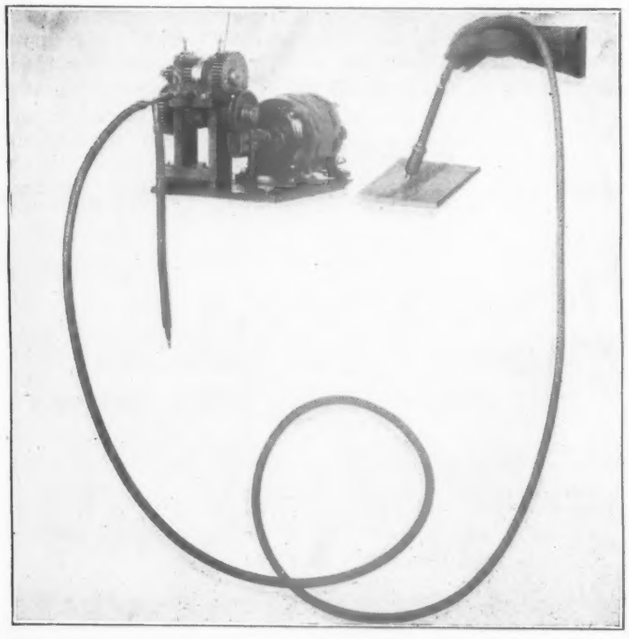
The bed is of the double ribbed girder type, heavily reinforced, and is cast integral with the head. The swing over the bed is 17 in. The drive may be either from a countershaft regularly supplied with machines not ordered with direct motor drive, or directly from a motor mounted on the rear of the leg, or on top of the head. A 5-hp., 1,200 r.p.m. motor of any make may be used.

A threading attachment of the leader and follower type can be supplied for this machine. With one gear shift each leader and follower enables two pitches of thread to be cut, which are one and four times the pitch of the follower. A taper attachment capable of turning any taper up to 3 in. per foot can also be supplied.

Electric arc welding in gaseous atmosphere

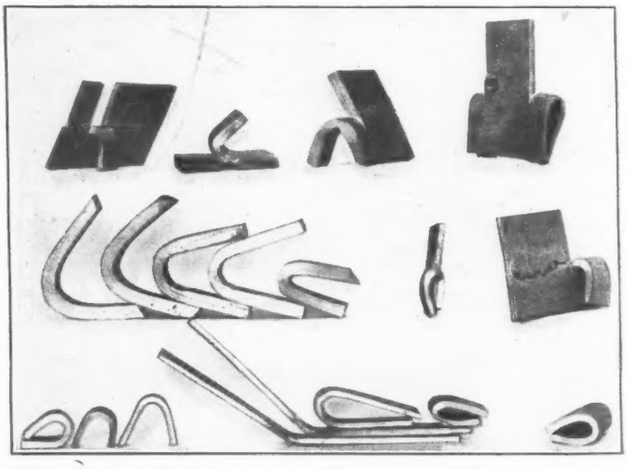
BY surrounding the ordinary welding electrodes with an atmosphere of hydrogen or certain other gases, it has been found by Peter Alexander of the Thomson Research Laboratory of the General Electric Company, Lynn, Mass., that it is possible to produce ductile welds. The gas acts as a flux and shield against the oxygen and nitrogen of the air; therefore, the formation of oxides and nitrides of iron in the molten metal is prevented. The process originated from the study of metallurgy of the arc-deposited metal and the causes that limit its ductility.

The method is based on the action of molecular hydrogen. This gas at high temperatures, even in the molecular state, is a very active reducing agent. When it surrounds the crater of the arc it acts in the same way as it does in the hydrogen brazing process. Yet certain peculiarities of the process—for example, the extremely high voltage drop at the cathode and anode of the arc burning in hydrogen—are due to the dissociation of the small amounts of molecular hydrogen in actual contact with the craters. Hence the apparent resistance of the arc, and consequently the amount of energy liberated, is about double that when the arc is burning in air.



Automatic wire feeding device with attachment for welding in hydrogen atmosphere

Consequently the weld is not only ductile, but the operation is much faster. The speed results both from the greater energy of the arc in the hydrogen atmosphere and the fact that the beveling of the edges of the material is unnecessary. Using 180 amperes and an arc voltage of 60, ¼-in. boiler plates, butted together without beveling, have been welded at a speed of 60 ft. per hour.

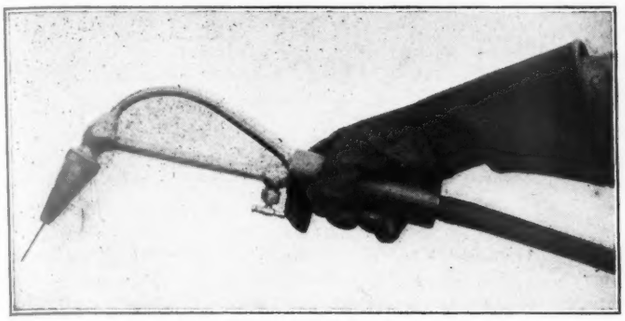


Transverse bends on samples of arc welds produced with a semi-automatic machine in hydrogen atmosphere

Ductility is a factor of prime importance in the welds of structures that are subjected to vibration, accidental bending stress, or overload. Also, ductility equalizes internal cooling stresses when present in the weld. If any part of the ductile weld is stressed beyond its elastic limit, it will not crack. It will yield until the stresses are more or less equalized all along the joint, which is so proportioned as to stand with safety the imposed load. It has also been found that the metal deposited in the hydrogen atmosphere has a higher elastic limit. The elastic limit of pure iron electrodes before deposition averages 29,000 lb. per sq. in.; the elastic limit of the same electrode deposited by the arc in hydrogen averages 42,000 lb. per sq. in.

In this welding process the arc is maintained inside of a hydrogen stream which burns along its outer surface of contact with air. The electrode is entirely surrounded by hydrogen, which eliminates the possibility of the metal

in the crater coming in contact with air. Direct current is used. The equipment as developed in the laboratory includes the direct-current generator, gas hose, and spool of welding wire mounted as a unit on one base. The



Torch for welding in hydrogen with a metallic electrode

welding wire, the hydrogen gas and the electric current are sent through a flexible hose to the torch nozzle.

After the work with the hydrogen atmosphere was found to be successful, experiments with mixtures of hydrogen and carbon monoxide were conducted in accordance with Professor Elihu Thomson's suggestion, and under his personal guidance. Water gas, containing about equal volumes of hydrogen and carbon monoxide, was next tried. It was found that welds produced in such an atmosphere were ductile and easier to produce. Work with various mixtures of carbon monoxide and hydrogen, produced either synthetically or by decomposition of various organic compounds, demonstrated that ductile welds can be produced in the atmosphere of any mixture of the two gases. Methanol or synthetic wood alcohol was found to serve well in this gas, so that transportation with portable outfits is facilitated.

A series of experiments with nitrogen-hydrogen mixtures showed that mixtures of these gases also give ductile welds. The use of liquid anhydrous ammonia which contains one volume of nitrogen and three of hydrogen, in this connection makes it possible to store large quantities of the gas in small volume as a liquid.

In its present state the process is being extended to the welding of alloy steels, non-ferrous materials and their alloys. The careful selection of the appropriate gaseous mixture determined by the nature of the materials to be welded is an essential factor for successful work.

Type M. S. O. automatic link grinder

THE M.S.O. automatic link grinder sold by the Marburg Brothers, Incorporated, 90 West street, New York, is provided with an attachment which holds the link so that it can swing around a center which is adjustable within certain limits. The attachment is connected to the work table, which is specially designed and which has an automatic lateral motion, in such a manner that the swinging motion is secured. The automatic reverse stops at the ends of the table motion are adjustable for different lengths of slots.

The link is held on its support by two angle irons or in two vises both of which are regularly supplied with the machine. For grinding of the link, a wheel of about 2 in. in diameter is generally used and the grinding head is adjusted to a slight longitudinal travel which is automatically reversed.

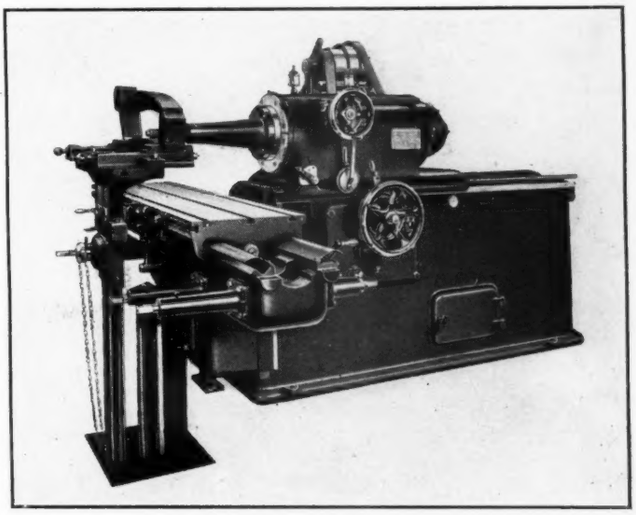
The grinder is arranged, furthermore, for grinding bushings and similar parts, in which case the upper part of the radial link support is removed. The bushings are fastened to the table by suitable supports which vary with the size and designs of bushings. Bushings which are not removable but fastened in levers, rods, etc., can readily be ground. The grinding of a number of bushings can be done in one setting as long as the maximum center distance is within the limits of the machine.

For the purpose of grinding pins a special attachment is used which can be furnished with the machine. This attachment is bolted to the grinding head in the place of the regular spindle used for grinding link motions, cylinders, etc. Removing the grinding spindle and mounting the special attachment requires only a few minutes.

The grinder is suitable for grinding brake cylinders, air compressor cylinders and steam chests within the limits given in the specification. The grinder is equipped with single pulley and gear drive. It is, therefore, equally well suited for individual motor drive and for a drive from a transmission.

The gear box for the drive of the grinding head is enclosed. The speed of the longitudinal travel is under the control of a single lever and requires no change of belt. All operating levers are located so that they can easily be reached by the operator without change of position.

The main guides are suitably protected against grinding dust. A central oiling system takes care of the lubri-



A grinder designed to grind valve motion links, bushings, pins and airbrake cylinders

cation as far as feasible so that only a few points require independent attention.

The dimensions and capacity of the machine are as follows:

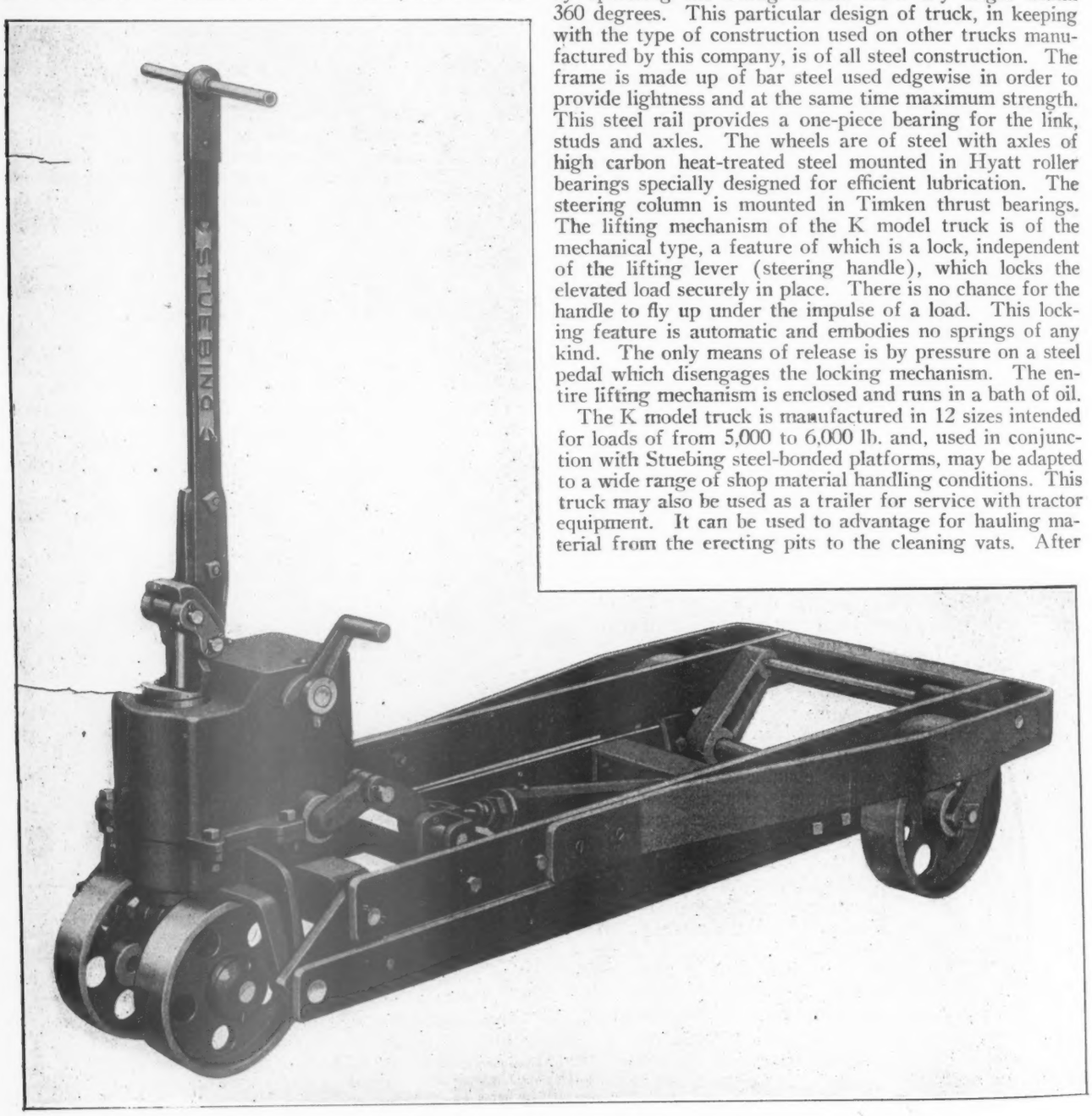
Maximum grinding length	20 in.
Maximum grinding diameter	12 in.
Maximum eccentric motion of spindle, diameter	1¼ in.
Size of work table	59 in. by 16 in.
Maximum lateral motion of work table	39½ in.
Maximum distance center of grinding head to work table	12⅝ in.
Minimum distance center of grinding head to work table	6 5/15 in.
Maximum longitudinal travel of grinding head	35¼ in.
Radius of link	29½ in. to. 89 in.
Maximum length of slot at radius of 89 in.	29½ in.

Maximum length of slot at radius of 29½ in.	19⅝ in.
Maximum diameter of pins (pin grinding attachment)	3⅛ in.
Maximum length of pins (pin grinding attachment)	4¾ in.
Number of speeds of longitudinal travel	3
Number of grinding wheel speeds	4
Dimensions of driving pulley of machine	11.8 in. by 4 in.
Speed of driving pulley	650 r.p.m.
Floor space required	9 ft. by 8 ft.
Power required	4 ft.
Net weight, approximately	6,600 lb.

Lift truck which raises load in four strokes

IN order to meet the demand for industrial trucks capable of handling heavier loads the Stuebing-Cowan Company, Cincinnati, Ohio, has recently placed on the market a mechanical lift truck which, while similar in many respects to earlier trucks designed by this company, has the added advantage of a four-motion multiple lift. This truck, known as the K model has a lifting leverage of 48 to 1. The lift is accomplished through four strokes of the lifting and pulling handle. A feature of this type of truck is the fact that the load may be lifted by operating the lifting handle from any angle within 360 degrees. This particular design of truck, in keeping with the type of construction used on other trucks manufactured by this company, is of all steel construction. The frame is made up of bar steel used edgewise in order to provide lightness and at the same time maximum strength. This steel rail provides a one-piece bearing for the link, studs and axles. The wheels are of steel with axles of high carbon heat-treated steel mounted in Hyatt roller bearings specially designed for efficient lubrication. The steering column is mounted in Timken thrust bearings. The lifting mechanism of the K model truck is of the mechanical type, a feature of which is a lock, independent of the lifting lever (steering handle), which locks the elevated load securely in place. There is no chance for the handle to fly up under the impulse of a load. This locking feature is automatic and embodies no springs of any kind. The only means of release is by pressure on a steel pedal which disengages the locking mechanism. The entire lifting mechanism is enclosed and runs in a bath of oil.

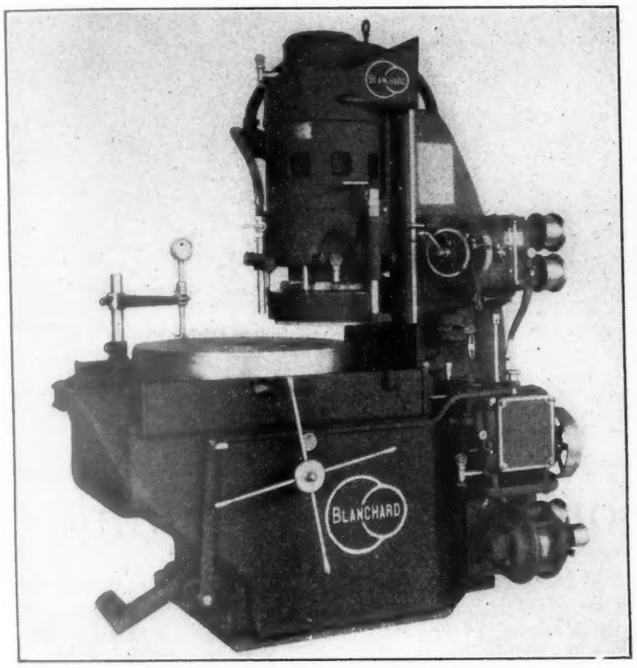
The K model truck is manufactured in 12 sizes intended for loads of from 5,000 to 6,000 lb. and, used in conjunction with Stuebing steel-bonded platforms, may be adapted to a wide range of shop material handling conditions. This truck may also be used as a trailer for service with tractor equipment. It can be used to advantage for hauling material from the erecting pits to the cleaning vats. After the work is cleaned the truck can pick up the loaded boxes and deliver them to the repair gangs. It can also be used by the stores department.



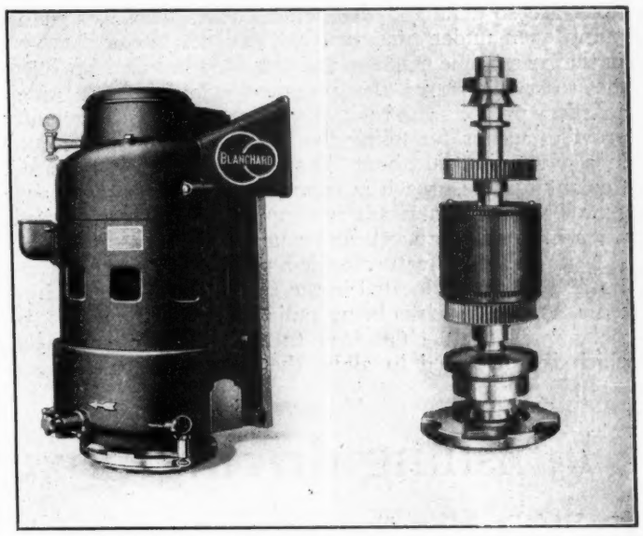
Stuebing-Cowan quick raising platform truck

Ball bearing wheel head for surface grinder

THE wheel head of the direct motor drive type of the No. 16 Blanchard vertical surface grinder built by Blanchard Machine Company, 64 State street, Cambridge, Mass., has recently been improved and simplified. The spindle is now carried on two large ball bearings in the sliding wheel head, with the upper bearing held up by springs which take up all end play and place a considerable thrust load in an upward direction on the lower or main bearing at all times. The bearings are of the Gurney, radial thrust type, and have capacities greater than the loads they are designed to carry. The lower bearing has 11 balls 1⅝ in. in diameter. The upper bearing is entirely covered and has no moving parts exposed at the top of the head. The wheel guard is held directly in the head, eliminating the spider casting formerly required in the older types of machines. Hexagon head ½-in. screws secure the wheel rings to the faceplate.



The No. 16 Blanchard grinder, direct motor drive type



At the left may be seen the new ball bearing wheel head and at the right the wheel head spindle

The older type of spindle, now used on the belt driven machines only, had the spring take-up feature but used four bearings.

Hydraulic broaching machine

A VARIABLE-SPEED hydraulic broaching machine, known by the designation No. 3L, has recently been brought out by the J. N. Lapointe Company, New London, Conn. In this machine, the cutting speed can be varied up to 24 ft. per minute, with a fast return speed of 60 ft. per minute. If desired, the return speed can also be varied from 10 to 180 ft. per minute. The speed changes can be made while the machine is running or when it is stopped, only a few seconds being required to adjust the machine to any predetermined rate of speed. The control arrangement is mounted on a control shaft which runs parallel to the crosshead ways and which can be locked at any cutting speed required.

The total stroke of the draw-rod is 56 in., the machine being provided with an automatic stop for controlling the length of the stroke. This stop is of the spring and plunger type and requires no wrench for its adjustment; it can also be set at will, for automatic return. Not only does this stop permit a variation of the stroke, but complete control is also provided by a hand-lever which permits the ram to be stopped or started in any position, either on the cutting or return stroke.

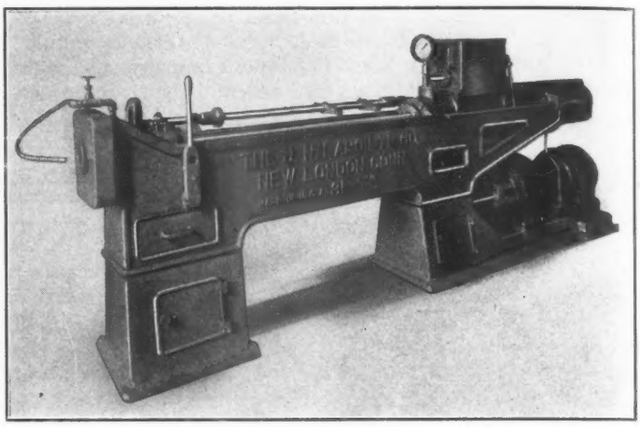
The machine, being built on the hydraulic principle, is provided with a low-pressure relief valve which automatically opens when the ram meets with undue resistance. This feature prevents the broach from being broken in case it should be backed up against the inside of the faceplate. The pressure for the hydraulic system is supplied by a Hele-Shaw variable-delivery multi-plunger hydraulic pump, made by the American Fluid Motors Company, Philadelphia, Pa. Each pump is subjected to a thorough test, before being installed, at a pressure of 1,500 lbs. per sq. in. For driving the pump, either a countershaft or a direct-connected electric motor drive may be used, a 7½ hp. motor being recommended. The speed of the pump is 900 r.p.m. The base for the motor is arranged to take any make of motor.

The ports are cored in the pressure cylinder to eliminate piping and possible leakage. Only two pipes are used in the entire hydraulic system, and these are made of extra heavy copper, neither being over 27 in. in length. The fast return valve is cast separate from the main cylinder, and all cored recesses are machined. The cylinder is 7 in. in internal diameter, and is mounted on the rear end of the machine bed, being bolted at its forward end to a crosspiece which is cast integral with the bed. At a pressure of 1,000 lb. per sq. in., which is the maximum pressure recommended and that for which the relief valve in the

pump is set, a pull of 31,400 lb. is exerted on the drawrod.

A system of linkage connects the operating lever and the control shaft with the pump. The latter is directly connected to an automatic valve, which, during the return stroke of the ram, permits the oil that produces the pressure on the cutting stroke to be transferred from one side of the piston to the other without passing through the pump. A reservoir above the pressure cylinder accommodates the excess oil during the working stroke. Connections are so arranged that when the relief valves in the pump open under pressure they exhaust into a reservoir in the base of the machine and the oil is pumped back into the reservoir above the pressure cylinder by a small auxiliary pump. The reservoir above the pressure cylinder provides means for filling the system, which can be done in a few minutes, about 20 gal. of oil being required. Coolant for the broach is supplied by a Brown & Sharpe geared pump. Lubricant is supplied to the broach, both when it enters the work and when it is leaving.

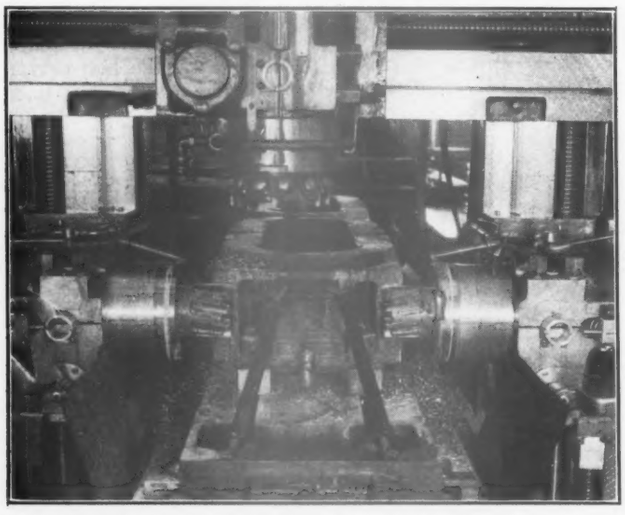
A time-saving feature added to the machine is a removable chip pan, located in the front part of the machine bed. As the broach is being pulled through the work, the coolant washes the chips from the tool down into this pan, which is perforated to allow the coolant to pass into a reservoir. As standard equipment the machine is provided with one reducing and one pull bushing. It weighs 6,000 lb., and occupies a floor space of 12½ ft. by 26 in.



La Pointe broaching machine

Finishing driving boxes on a milling machine

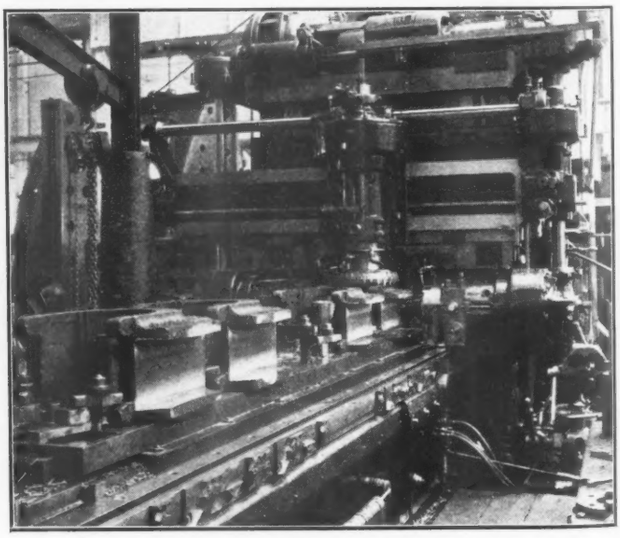
SHOWN in the illustrations are two views of the three-head adjustable rail milling machine, manufactured by the Ingersoll Milling Machine Company, Rockford, Ill., finishing the faces, and shoe and wedge fits of locomotive driving boxes. This machine has been especially designed for such work. The bed is the full width of the table and the housings and rail have wide bearing surfaces. The saddles are of heavy construction and are equipped with 6-in. spindles. The gears in the horizontal heads are 16 in., and the gear in the vertical head, 20 in. in pitch diameter. All the gears are hardened forgings throughout, enclosed and running in oil. The machine is driven by a 40-hp. motor through 3¼-in. shafting which provides ample power for heavy milling.



The two special cutters are just finishing the final pass on the shoe and wedge fit—The cutter in the vertical head is raised after finishing the faces

The vertical feed of the two side heads may be controlled by hand, the operator being guided by markers fastened at the side of the table. The machine, however, can be fitted to have this feed control automatic. This feed is actuated by the dogs shown on the side of the table in one of the illustrations. When automatic feed is provided, the operator is able to load and unload the driving boxes while the machine is in operation, taking the boxes off the rear of the table while those at the front are being milled and vice versa, thus saving considerable time.

Tests conducted by the manufacturer showed that a driving box could be milled complete in 52½ minutes, floor to floor. This time included milling both faces, the edges of the flanges and both the shoe and wedge fits including all taper angles. The boxes were milled com-



A large type "S" cutter is used in the vertical head for milling the faces—The special type end mills are shown in position to mill the taper angles

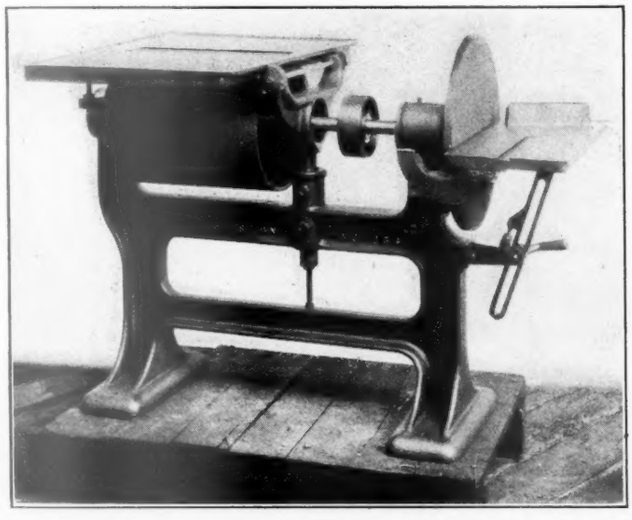
plete from the rough in two settings. In the first setting one face and the outside edges of the four flanges are milled. This is done with the vertical head in one or two passes, depending on the width of the face. The boxes are then turned over and set on the face finished in the previous operation. The first pass or two passes mill the opposite face as in the first setting. Special end mills are used in the two horizontal heads for milling the shoe and wedge fits at the same time, including the taper angles as shown in one of the illustrations. This is done by means of the power vertical feed on the horizontal heads which can be thrown in or out, and reversed independently of the double feed. The combination of the two feeds, mills the taper, the angle of which can be varied by means of pick-off gearing. Milling the shoe and wedge fits requires two passes. The first pass mills half the bottom and one set of tapers, the second finishing the bottom and the other taper.

As shown in one of the illustrations, these tests were performed with four boxes mounted on the table in an experimental fixture. They may, however, be mounted in a fixture for holding more than this number.

This milling machine can be used as a general purpose machine for face milling iron or steel castings. It can also be fitted with an arbor driven from one or both of the horizontal heads and used for such work as milling shoes and wedges, crossheads, or any other work requiring arbor milling.

Two machine tools for the woodmill

THE American Saw Mill Machinery Company, Hackettstown, N. J., have placed on the market a bench band saw and a drum and disc sander which are especially adapted for use in the woodmill of a railroad shop. The band saw may be operated by belt or by



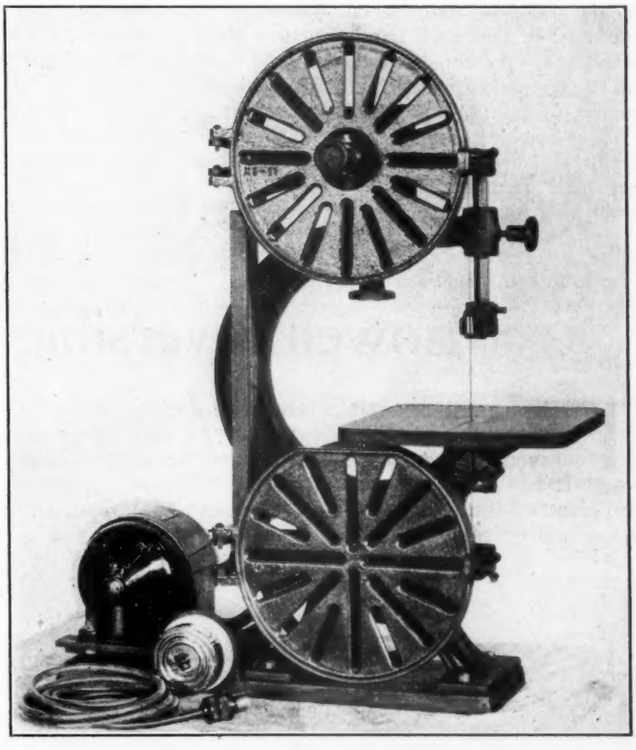
Combined drum and disc sander for sanding flat or bent work

electric motor from the lighting circuit. The frame is constructed to insure maximum rigidity and strength without being unduly heavy. The wheels are balanced and equipped with rubber bands and the table is made of cast iron, equipped with a babbitted throat for the saw. It may be tilted to any angle up to 45 deg. and is held by a positive clamp. The alinement of the upper wheel is maintained by means of a convenient hand wheel and the saw may be lined on the wheel when the machine is in motion. The lower wheel is also adjustable for alinement. The tension of the saw is regulated by means of a hand wheel, screw and compensating spring, and may also be adjusted while the saw is in motion.

The wheel guards are hinged to rigid frames and are locked in place by thumb nuts. The saw is further protected by a long guard placed at the back between the upper and lower wheels. The machine is regularly equipped with a plain guide above and below the table. A roller guide above the table, however, can be furnished if desired. Machines equipped with electric motors have the motor and starting switch mounted on a cast iron sub-base to which the machine is also attached, making a self contained unit. A small endless belt from the motor drives the lower shaft.

The height of the machine with the sub-base is 36 in. and without the sub-base 34¾ in. The overall width is 16 in. and the table is 12 in. by 12 in. The wheels are 12 in. in diameter with a 1 in. face. The guide is adjustable as to height and may be raised to a height of 6 in. above the table. The saw wheels operate at a speed of about 800 r.p.m.

The combined drum and disc sander is designed for use for sanding straight or bent work on the drum or for



Bench type band saw equipped for electric motor drive

general disc sanding. The drum is 13 in. in diameter with a 16-in. face and is provided with groove and clamping strip to hold and stretch the sand paper and carpet. One end of the carpet is fastened to the drum, the other end being clamped with the paper. The drum table, 21 in. by 32 in., is provided with a suitable opening for the drum,

and is adjusted by means of screws to the required position for flat sanding. The table may be removed for sanding curves and work of a similar nature. The disc is 18 in. in diameter and is accurately turned and balanced. The disc table is 10 in. by 25 in., and is adjustable to any angle up to 45 deg. in either direction. It is fitted with a grove and miter fence for sanding angular work. The main frame is cast in one piece of sufficient weight and strength to prevent vibration. The arbor runs in ball bearings and is regularly equipped with a pulley 6 in. in diameter and 4 in. wide. The floor space occupied by this machine is 49 in. by 32 in. It is recommended for use with a 2-hp. motor which will operate the sanders at an arbor speed of about 1,000 r.p.m.

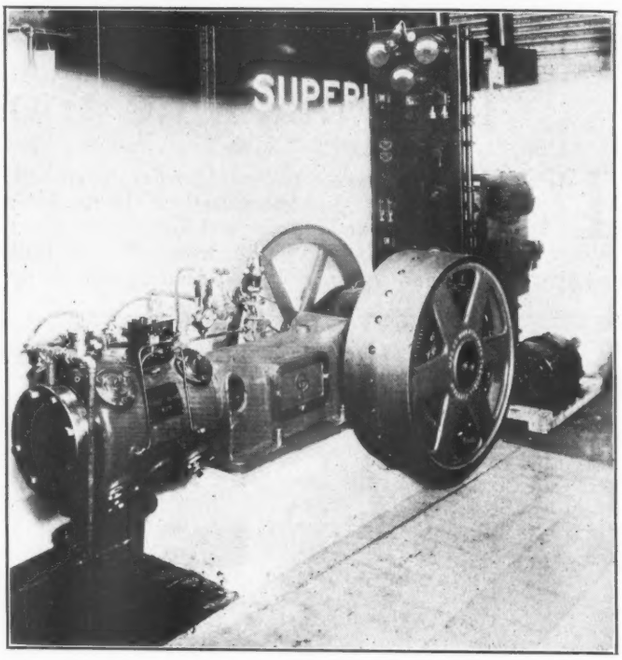
Fly wheel synchronous motor

A FLY-WHEEL type of synchronous motor in which the fields and the rotor revolve outside the stator, has been placed on the market by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. These overhung synchronous motors are particularly adapted for air and ammonia compressors. They are limited in horsepower rating from 15 to 100 hp. and speeds from 164 to 400 r.p.m. The machines may also be used as alternating current generators to be driven by small steam engines, oil engines or gas engines. It can be used for the latter purpose in almost any railway shop.

In several cases where it was desirable to obtain a large fly wheel effect, it was found practical to build a double-rim wheel, mounting the alternator on the inside of the inner rim and using the outside rim for the fly wheel effect required. This combination increases considerably the capacity of the machine.

As all of the vital parts are inside, it is claimed that this rotor construction does not require such careful handling as the old type and the rotor may be rolled on the floor without, in any way, damaging the poles or squirrel cage windings. As constructed, the new machines form a part of the compressor unit. It is shipped ready to run and no motor foundation or erecting work is necessary.

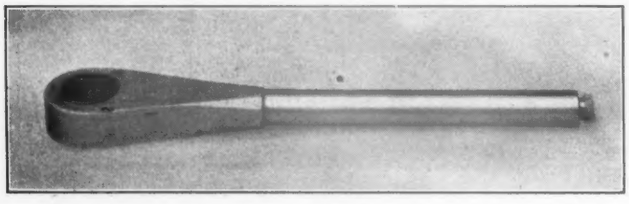
The machine can be used in small locomotive and car shops and around engine terminals where large air compressors are not available. It can be used in case of an emergency as no permanent foundation is necessary.



Reduced voltage starter for high speed synchronous motor

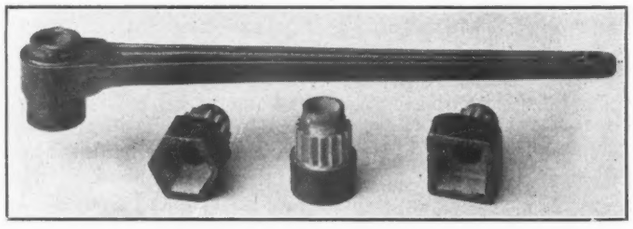
Lowell reversible ratchet wrenches

THE Lowell reversible ratchet wrench is made in seven different standard patterns with three to seven different sizes and various lengths of handles. It has a capacity range in these different patterns and sizes of from ½ in. to 5 in. across the flats in either hexagonal or square shapes.



Lowell No. 1916 pattern reversible wrench

The wrench is reversible in action, a simple movement of the hand adjusting the ratchet to cause it to operate either as a right or left hand tool. The fact that a ratchet wrench, when once engaged with the part which is to be turned, does not have to be removed until the turning operation is completed, results in speedy operation, whether it is used in the open, or in a place difficult of access.



Steel socket reversible wrench

Wrenches of this type can be used to advantage in locomotive repair shops where it is difficult to use a jaw or closed type of wrench. It can also be used in the car department, by the machine tool repairmen or in fact any place where wrenches are a necessity.

These wrenches are manufactured by the Lowell Wrench Company, 54 Commercial St., Worcester, Mass.

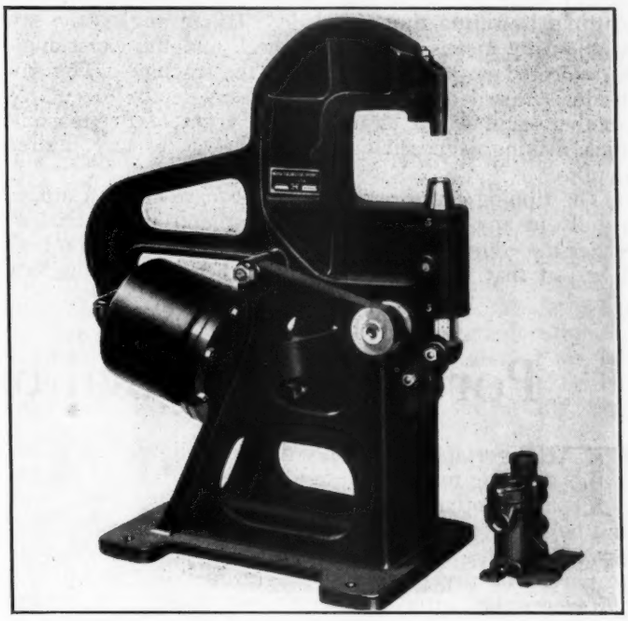
Hanna rapid riveter

THE new Hanna rapid riveter, manufactured by the Hanna Engineering Works, Chicago, Ill., which permits inserting rivets from above and driving from below is shown in the illustration. This feature and a speed of 50 strokes per minute has made possible some unusual riveting records with this rapid riveting equipment.

This machine can be used for certain classes of work in the boiler shop as well as in the passenger and freight car departments.

The mechanism is a combination of simple lever and toggle which combines a long die stroke with a wide range of uniform pressure, thus eliminating the necessity of screw adjustment on the die. The die travel is very rapid as the die approaches the work. The die or plunger speed gradually decreases until it enters the uniform pressure area of the stroke—hence the pressure is uniform. The advantage of this die stroke is, where the work is lightest, the speed is greatest; as the rivet head forms, the pressure increases, reaches a maximum and maintains it for several inches of piston travel. Ordinary variations in rivet lengths and plate thicknesses are automatically taken care of by the wide range of uniform pressure.

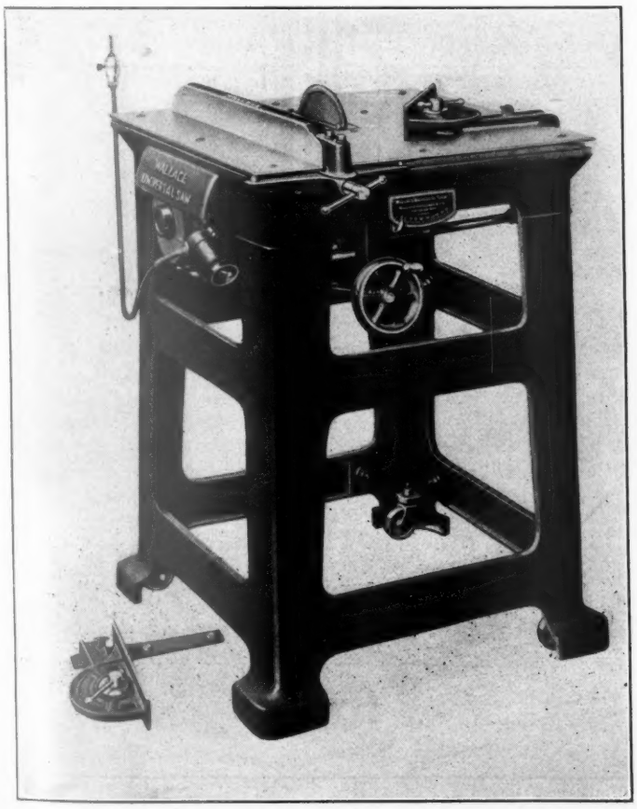
The machine is made in sizes capable of driving ¼-in. to ½-in. rivets hot and 3/16-in. to ⅜-in. rivets cold. It can also be used for punching.



Rivets are inserted from above and driven from below

Large portable universal wood saw

THE accompanying illustration shows the new and larger Wallace portable universal wood saw manufactured by J. D. Wallace & Company, 158 South California avenue, Chicago. The one-way castors make it easy to move from one department of the shop to another and yet it is rigid in operation. The motor and all working parts are built into the upper portion with the table and fences, thus the top part is a complete self-contained bench type saw when lifted off the regular stand. When it is desired to take the saw out on a job and it is not convenient to take the regular cast iron stand, the saw can be taken without its base and placed on any substantial wood stand.



Wallace No. 9 portable universal saw, left side view

The No. 8 machine, equipped with a 1-hp., three-phase motor has ample cutting capacity with precision accuracy; angle cutting, either rip or cross cut; large size table with a capacity of 12 in. by 2¼ in. between the blade and fence.

A constant speed air-cooled motor is directly geared to the saw spindle, thus eliminating all belts and their attendant troubles. Ball bearings on the motor are provided with an adjustment for taking up any play. The saw spindle bearings and gears are automatically lubricated by a splash oil system.

The motor operates on either an electric light or power circuit. It is started and stopped by means of a toggle switch located on the motor itself. The toggle is protected by a cap-shaped cup which prevents accidental starting of the motor by brushing against the toggle.

The table is one piece of finished steel, 25 in. by 25 in., fitted with a removable throat piece so that special saws, dado and cope heads requiring a wider throat opening may be used. This machine is designed to handle the smallest and most delicate work with accuracy and yet is powerful enough rapidly to cut stock 2¼ in. thick. Utilizing the various adjustments, it is also capable of cutting compound miters, grooves ⅞ in. wide and 1 in. deep, moldings, groove and tongue, etc., by means of a special dado head.

To cut various angles, the saw is tilted instead of the

table, thus the operator is always working on a table that remains in a horizontal position. It is possible to cut at any angle up to 45 deg., while either ripping or cross cutting, by tilting the saw blade. To cut angles, the saw is tilted by means of a hand wheel, and the exact angle is indicated on a dial in front of the machine. The saw blade is raised or lowered for various depths of cuts by another hand wheel located in the front of the machine thus making it possible to cut grooves to any desired depth.

The ripping fence resembles a T-square and is clamped rigidly in any position to a rail at the front of machine under the edge of the table. The fence is ground on both faces so that it can be used on either side of the saw blade. It can be removed from the table when not in use.

Two-cross cut fences are provided so that right or left-hand mitering up to 50 deg. can be done. The angle is indicated on a degree plate located on each fence. Provision is made for taking up any play, thus assuring accuracy. These fences slide on rails on each side of the machine under the edge of the table where they will not become clogged with sawdust, rosin or pitch and where they will not interfere with the quick adjustment of the rip fence. Both fences can be removed when not in use. The saw blade above the table is protected by the Wallace shutter saw guard which acts automatically in protecting the running saw blade. The saw below the table is protected by a fixed cage guard.

Portable universal boiler and fire box drill

THE portable electrically driven drilling, boring and tapping machine, here illustrated, is chiefly used in locomotive and car manufacturing shops, tank and boiler shops as well as locomotive repair shops. The two advantages in using it are that the machine can easily be moved to any place and put in operation in any required position without elaborate preparations for setting up the work, and that it can be employed in places where it is impossible to work with any other drilling machine. It is built by the Giddings & Lewis Machine Tool Company, Fond du Lac, Wis. When drilling holes of small and medium diameters the weight of the machine affords sufficient stability. For drilling larger holes or when the head is high on the supporting column the rigidity of the machine is strengthened by four spreaders attached to the base plate.

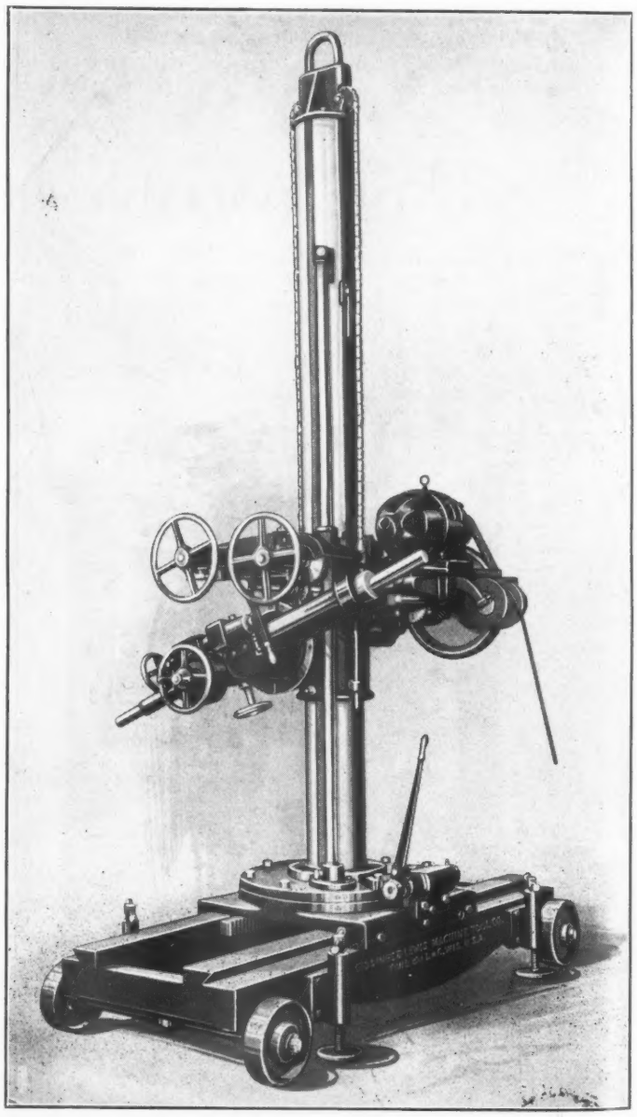
The column is of a heavy tubular section and well braced to withstand all strains. After being machined it is ground to diameter and fully balanced. There is a self-contained drill spindle unit consisting of a heavily ribbed box section, having long guiding ways to insure correct alinement on the column. Power feed is provided for moving the spindle head on the column. The complete spindle unit can be clamped to the column at any desired location. The spindle is made of high-carbon steel and runs in bronze bearings and is liberally supplied with oiling facilities. A friction clutch is provided to reverse the spindle for tapping. Furthermore, a segment on the spindle head permits the setting of the drill spindle at an angle of 30 deg. from the center line of the column in both directions. The complete spindle unit is properly counterbalanced through the chain, sheave and counterweight, the latter sliding in the column.

The driving motor is mounted on the spindle head and the power is transmitted to the speed box through a pinion gear. A winding reel with 30 ft. of cable is furnished with the machine for connecting with available current.

The speed and feed box is a self-contained unit. The levers for changing the speed and feed are easily accessible and within the reach of the operator at all times. The gears run in heavy oil and are enclosed by the speed case proper, the cover of which is easily removed for inspection.

The portable base is of heavy ribbed girder construction and is provided with a planed runway for supporting the platen for the column. A rack and pinion, of liberal size, including a ratchet lever, is furnished for moving the drill on the runway. All of these drills, which are designated as No. 250, are furnished with a segment, worm and ratchet lever to enable a 30 deg. movement of the column in both directions. The controls are centralized.

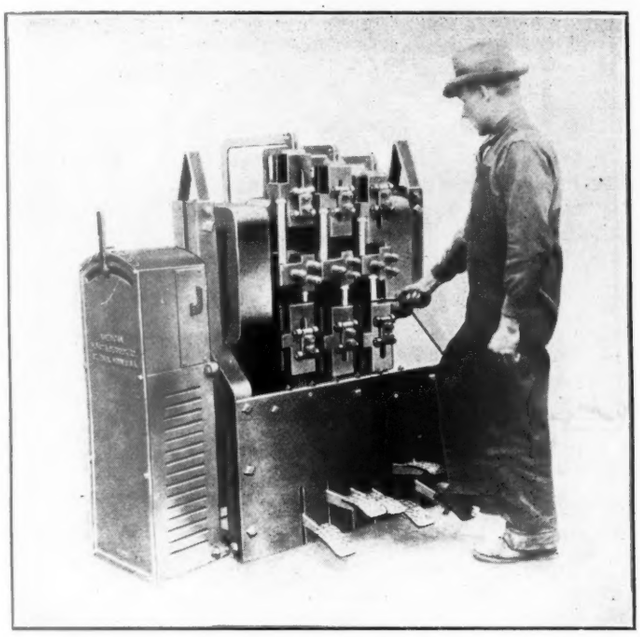
Lubrication of all moving parts has been provided for by a few central oiling points from which the oil is automatically distributed to all parts.



Portable universal boiler and firebox drilling machine mounted on a four-wheel truck

The American electric rivet heaters

THE American Hoist & Derrick Company, St. Paul, Minn., has recently placed on the market electric rivet heaters which are built with an interchangeable center contact block. This enables the operator to unclamp the mid-section and repair any pit marks that



Six rivets can be heated at one time in this American rivet heater

may have developed during several months of constant usage. The pits in this center contact block, as well as in the interchangeable sliding jaws, can then be filled with welded copper which, when cool, is hammered down to add hardness. The contact surfaces of the jaws and center blocks can then be gone over with a file and polished with sand paper.

The heat control is another feature of these heaters. The control instantly regulates the current so that rivets from ¼ in. by ½ in. to 1 in. by 8½ in. can be heated quickly and without burning. This fits these machines for heating nuts, pins, bolts, etc., for tempering. The Models B and BB rivet heaters have been provided with nine steps of heat control; the Models A and AA heaters have been provided with six steps, while the Model C has six steps of control which permit 24 heat combinations to be made. The control is conveniently located at the left of the operator, and the amount of current can be immediately changed by the operator without moving from his position.

Due to the step arrangement, and the uniform contact tension on the heater's sliding jaws, mushrooming of rivets does not occur. These sliding jaws, which are the contact blocks, are manipulated by foot pedals. The jaws slide up and down giving a perfectly square and constant end compression on every rivet, regardless of the length. Another advantage of the sliding jaw design is that it permits a minimum and constant air gap between the secondary "E" elements and the laminated iron core, their source of power. This is the main cause of the high power factor obtained. The sliding jaws, previously mentioned, permit these "E" elements to be constructed of solid cast copper in such a manner as to hug the laminated iron core on three sides. These elements with their sliding contact blocks or jaws are made so they have thirty times the current carrying capacity of a one-inch rivet.

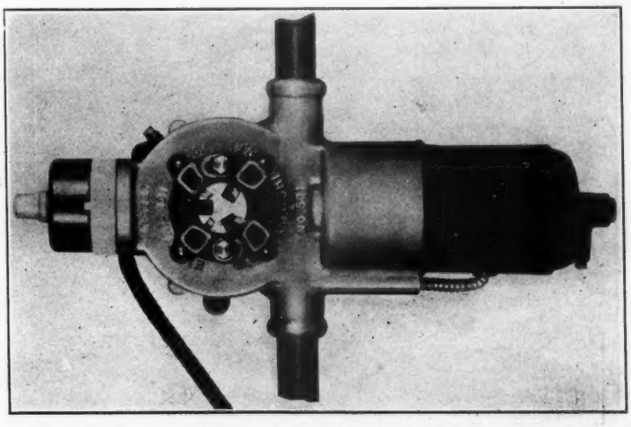
The transformer has been placed close to the field of action and within a few inches of the rivets to be heated, thus eliminating the necessity of conducting the secondary current by cable.

Electrically operated die stock

AN electrically operated die stock for threading ⅜-in., ½-in. and ¼-in. pipe has been developed by the Oster Manufacturing Company, Cleveland, Ohio. Referring to the illustration, the die head is actuated by a fully inclosed universal motor which can be operated from any lamp socket with either d.c. or a.c. current of 110 volts, and in any cycle between 25 and 60, inclusive. The gear reduction from the motor to the die head is enclosed in a housing of aluminum alloy which reduces the weight to less than 35 lb.

The tool is placed on the end of a stationary length of pipe in exactly the same manner as though the operator were threading the pipe by hand. It is centered by means of a universal chuck instead of loose bushings which gives the proper alinement and also eliminates filing burrs off the thread. A separate die head is furnished for each size of pipe. The dies are changed from one size to another by removing a pawl which holds the die head to the rotating sleeve.

The switch for starting and stopping the universal motor is located at the top of the tool where it is conveniently reached by the operator. A quarter turn of this switch rotates the die head, another quarter turn stops the motor and a further quarter turn reverses the motor for backing the dies off the thread.



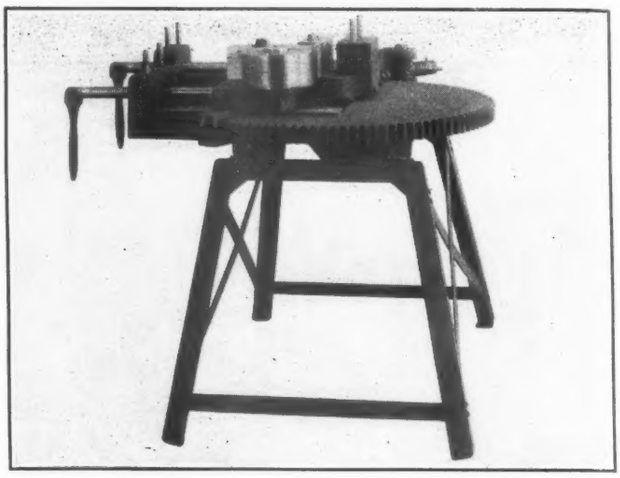
Electrically operated die stock for threading small pipe

Wallace No. 9 hand operated bending machine

THE No. 9 hand operated bending machine manufactured by the Wallace Supplies Manufacturing Company, 1312 Diversey parkway, Chicago, is designed for making sharp corner bends of 90 deg. or less and radius bends of 180 deg. or less, in flat, round or square bars and in pipes and conduits, thus covering a wide range of this class of work usually found in most railroad shops.

The pressure rolls and also the eccentric clamping device for holding the stock, to prevent slippage in the process of bending, are mounted on movable blocks fitted into tapered slides. Each block is operated by means of a large screw to permit of quick adjustment to suit the various sizes of forms as well as the different thicknesses of materials. Bolts are no longer required for clamping these parts to the machine, and the setting up of the dies or forms for various kinds of materials is, therefore, accomplished with comparative ease and rapidity. The tapered slides are of sufficient strength to withstand the pressure and strain of bending the maximum sizes of materials for which this machine is rated to handle in the repair shop.

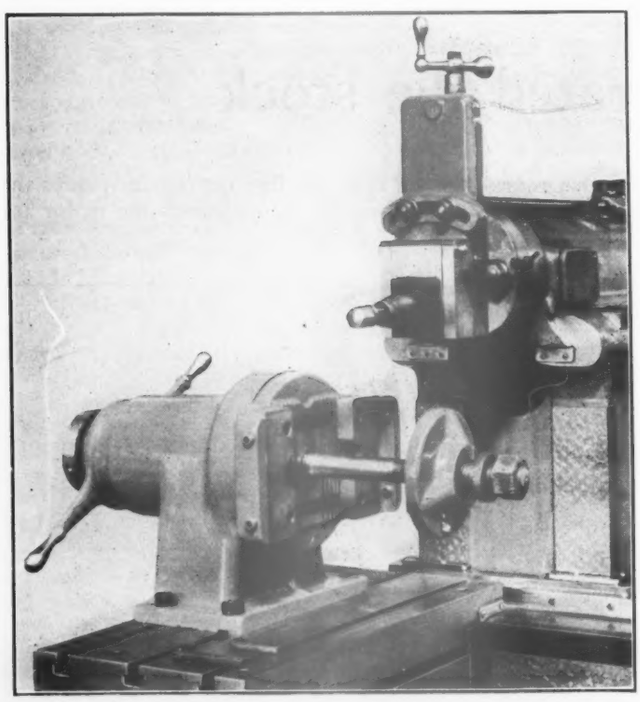
When bending material cold, the machine will handle ¾-in. by 4-in. flat stock, 1½-in. round, 1¼-in. square and 1¼-in. square twisted or less. When bending hot material, the machine will handle 1 in. by 4 in. flat, 1¾ in. round, 1½ in. square, and 1½ in. twisted or less. For bending ⅞ in. round or square bars or anything smaller, the ratchet handle may be thrown out of engagement and the direct lever used. A rod or pipe about 4 ft. long is then inserted in the socket provided for this purpose. In service an auxiliary ratchet lever operates a pinion against a series of teeth in the frame at a large enough ratio to handle the work.



Wallace No. 9 hand operated bending machine

Rod brass fixture for railroad shaper

THE Cincinnati Shaper Company, Elam street and Garrard avenue, Cincinnati, Ohio, has developed a rod brass fixture for its railroad shaper, the use of which makes it more convenient for the operator to index a fixture than to change or reset the tool after finishing one side of the rod brass. In using this fixture it is intended that the tool will be set for finishing down the inside of the flanges, and after one side of the rod brass has been finished, it is only necessary to raise the tool vertically.



Fixture designed for facilitating the finishing of rod brasses

The fixture is indexed for finishing the adjacent side without changing the setting of the tool and this operation is repeated until all four sides are completed. This system of indexing insures the inside faces of the four adjacent flanges being in the same plane and that all faces have an equal bearing all around on the side of the connecting rod solid end.

Referring to the illustration, the fixture is indexed by moving the hand lever to the left, which unclamps and automatically rotates the work. Moving this lever to the right, clamps the work in the fixture. The brass is held by a clamp bolt provided with floating washers. Adjustable chuck jaws hold the two halves of the rod brass against any tendency to open under pressure of clamping or under the cut, thus reducing to a minimum the possibility of spoilt work.

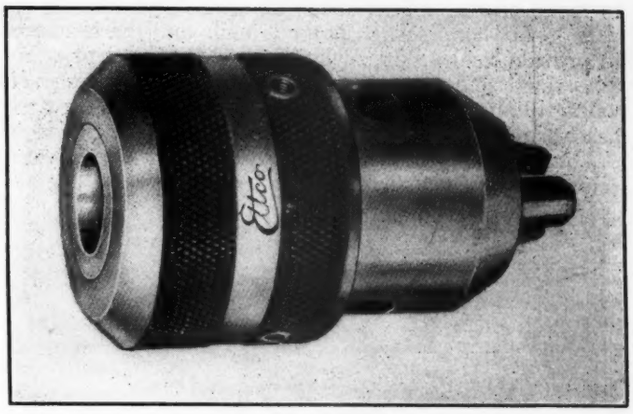
The fixture is of rigid construction and the design of the work holding device is sufficiently heavy so that it is not necessary to use any outer supports, shims or wedges under the outer edge of the brasses being machined. The fixture is, however, so designed that the work overhangs the table sufficiently to permit them to be used. This fixture will handle brasses from 11 in. up to 15 in. over the flange thus making it possible to handle a majority of the brass usually repaired in the average locomotive machine shop.

A keyless self-tightening drill chuck

THE feature of the new Ettco keyless self-tightening drill chuck, manufactured by the Eastern Tube & Tool Company, Inc., Brooklyn, N. Y., is that it has a continuous grip. The chuck does not depend on the operator to tighten it sufficiently to hold the drill, as it is only necessary to close the chuck by hand; the chuck then takes its grip after the work has been started.

As the drill point goes deeper, the load on the chuck increases with a corresponding increase of the grip. No matter how tight the chuck grips, it can be released by hand.

The chuck is self centering, keyless and provided with ball bearings. It is manufactured in four sizes which will hold any size drill from the smallest up to and including 5/8 in. It is particularly recommended for use with electric drills.

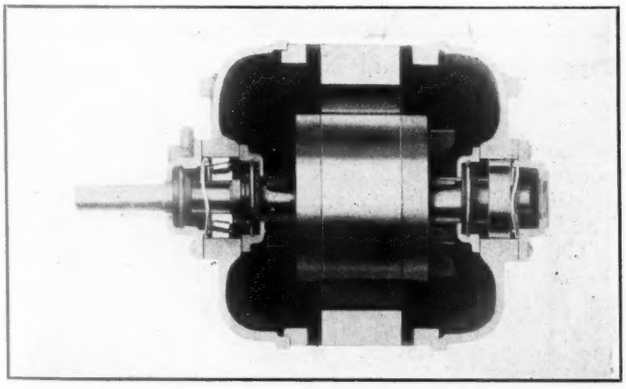


Keyless continuous grip drill chuck for electric motors

Automatic rotor recentering bearings for motors

IT has been stated by many practical operating men of electric motors that 95 per cent of motor troubles may be traced to bearing failure. Many of these troubles are the result of bearing wear so as to allow the rotor to rub on the stator.

In order to insure a continuous uniform air gap in motors, the Howell Electric Motor Company, Howell, Mich., has developed a complete line of motors with anti-friction bearing, in which any looseness in the bearing, caused by wear or otherwise, is instantly and automatically taken up, so as to keep the rotor of the motor continually centered with a uniform air gap. This is accomplished by the use of a Timken tapered roller bearing, shimmed with a fluted wire spring which acts as a compression spring. The inner race or cone of the Timken bearing is

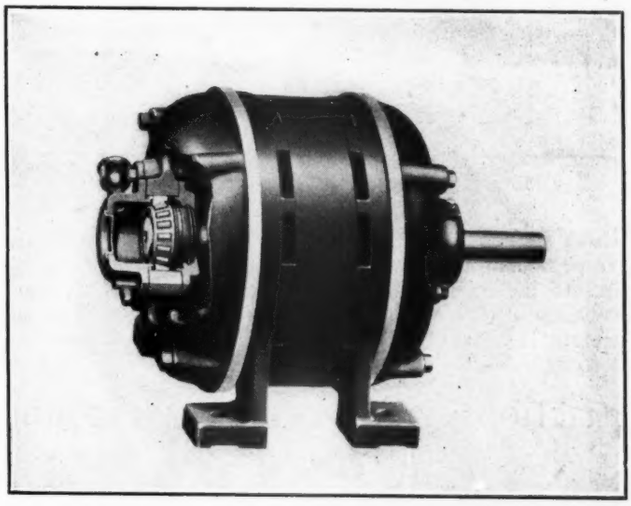


Cross-sectional view, showing the bearing arrangement in the Howell motors

fitted on the shaft with a light press fit. The outer race or cup is fitted into the housing of the motor end bell with a sucking fit which allows creeping of the outer race. The spring is held tight against this outer cup by the outer grease cap, pushing the cup tightly against the rollers and keeping the bearings tight at all times.

This type of bearing in each end of the motor keeps the rotor automatically centered at all times, and the spring allows for any lateral expansion of the shaft which might occur due to heat. Timken tapered roller bearings of nickel-molybdenum alloy steel are used throughout. With this method of spring adjustment, these bearings are expected to last the life of the motor if properly lubricated.

These bearings are arranged for grease lubrication and effective seals are used to keep the grease in and to keep



This motor is equipped with Timken nickel molybdenum roller bearings

out dust, dirt or abrasives. The motors can be mounted in any position without changing the end bells. They will operate in any vertical position as well as horizontally, as the bearings have a thrust capacity equal to their radial capacity.

Redesigned universal cutter and tool grinder

THE No. 1 universal cutter and tool grinder manufactured by the Gallmeyer & Livingston Company, Grand Rapids, Mich., has been redesigned to provide for a self-contained motor drive, thus eliminating overhead obstructions. The machine is equipped with a 3/4-hp.

motor mounted in the base and bolted through the column to the grinding wheel spindle. A swing door on the base makes the motor easily accessible when it is necessary to make bearing adjustments, clean the commutator, etc.

A ½-hp. lamp socket motor is built into the headstock to provide for handling cylindrical and internal grinding The work spindle is driven by means of a worm, providing the necessary slow speed and eliminating the overhead drum.

Longitudinal, transverse and vertical movements are controlled by conveniently placed hand wheels. The ma-

Motor-driven universal cutter and tool grinder

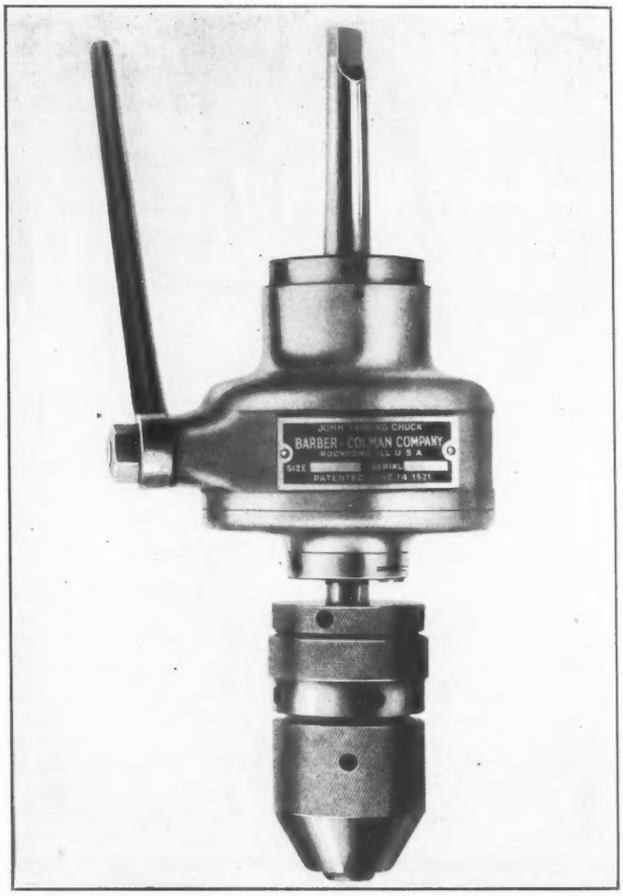
chine swings 9½ in. in diameter up to 20 in. wide. A vertical longitudinal and transverse movement of 6¾ in., 15 in. and 7 in., respectively, is provided. It has a capacity of 12 in. for face milling cutters. The net weight is 585 lb.

Friction-drive reversing tapping chuck

THE Barber-Colman Company, Rockford, Ill., has recently placed on the market a friction drive reversing tapping chuck. This device is known as the John reversing tapping chuck and is designed to convert drills or speed lathes into tapping machines. It drives a tap direct from the spindle through an internal clutch and friction driver member. The friction drive can be adjusted to drive small taps without forcing them to the breaking point, or it can be set to act as a nearly positive drive for the heavier taps.

The tap is fed into the work and automatically reversed by the lowering and raising of the drill press spindle. The reversing speed is twice that of the forward speed. The entire driving mechanism is balanced and concentric with its spindle. The unit is inclosed in an oil-tight case, permitting all gears and moving parts to run in heavy oil or light grease. A hold rod is bolted to the case to prevent the body of the chuck and the plate carrying the reversing idler pinion from rotating. The rod can be used whether the chuck is fitted on to a drill press or on to a speed lathe.

The jaws of the chuck are loosely keyed together with a keeper plate, but are free to slide in the drive shank. The inner ends of the jaws are beveled, and as the closing nut forces the jaws to grip the tap, the jaws accommodate themselves to the square of the tap shank. The metal parts in the tap-holding and friction-drive unit are made



Tapping chuck designed to convert drills or speed lathes into tapping machines

from steel and are heat-treated, as are also the center gear, pinions and clutch members. The internal gear is of bronze. The bearings are bushed and are renewable. The inclosing case is made of cast iron.

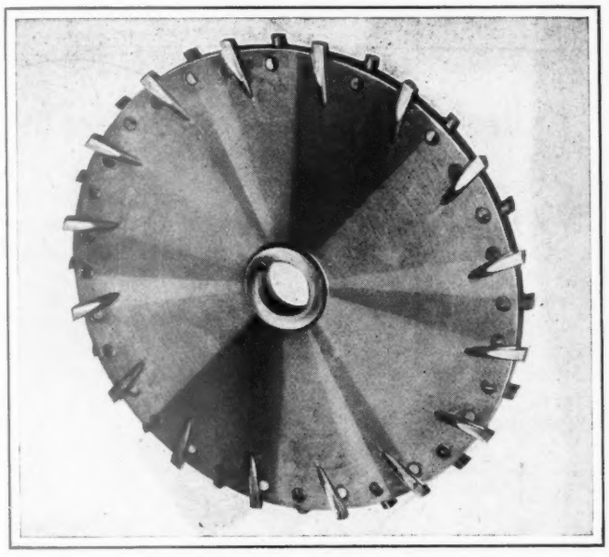
The chucks are made in two sizes: No. 1 for taps from 0 to ⅜ in., and No. 2 for taps from 0 to ⅝ in. They are equipped with Morse Nos. 2 and 3 taper shanks, respectively.

An alloy steel for dies

A STEEL known by the brand name "Crocar" has recently been developed and introduced by the Vanadium Alloys Steel Company, Latrobe, Pa. Crocar is essentially a high carbon, high chromium steel but also contains other alloys. It is unique among tool steels because of its high wearing or non-abrasive qualities and is adapted for a wide range of tools and dies. It does not make a good cutting tool because it does not have the property of red hardness, but is used principally for blanking and forming dies, drawing dies, roller threading dies, plug and ring gages, punches, etc.

Lovejoy deep slotting cutter

A CUTTER for use in machining slots varying in width from 5/8 in. to 1 1/8 in. and in cutter diameters above 6 1/2 in., has recently been placed on the market by the Lovejoy Tool Company, Inc., Springfield, Vt. The

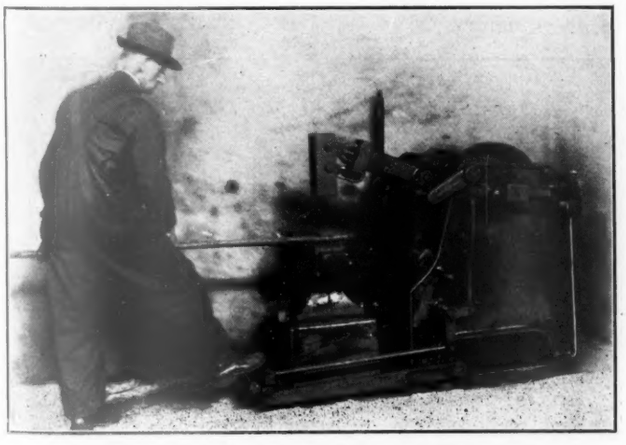


Lovejoy Type F deep slotting cutter

blades are positively locked and have a slight side clearance. The angle at which the blades are set in the cutter center is dependent on the width of the slot which is to be cut. Each insert has a liberal length allowance.

Chambersburg blacksmith hammer

A BLACKSMITHS' hammer designed to serve as an auxiliary to practically all forging operation in blacksmith and forging shops, has recently been placed



The head of this hammer weighs 50 lb. and strikes at a maximum rate of 218 blows per minute

on the market by the Chambersburg Engineering Company, Chambersburg, Pa. This hammer is, in reality, a mechanical "sledge man," capable of any intensity of blow from a tap to one far beyond human possibilities. The hammer head is so suspended that its face is always parallel to the anvil.

A power traverse, operative from the treadle which controls the blow, permits work on any part of the anvil face.

The hammer head weighs 50 lb. and strikes at a maximum rate of 218 blows per minute. A 2 1/2-hp. motor, mounted on the frame, is required to drive the hammer, or power can be transmitted from a line shaft.

Steel equipment for the toolroom

THE Lyon Metallic Manufacturing Company, Aurora, Ill., has developed a line of standard steel toolroom equipment which is built in individual sections, like that shown in Fig. 1. All sections are 7 ft. high, 3 ft. wide, by 1 1/2 ft. deep. The shelves are adjustable on 1 1/2-in. centers and the crosswise dividers are adjustable on 1-in. cen-

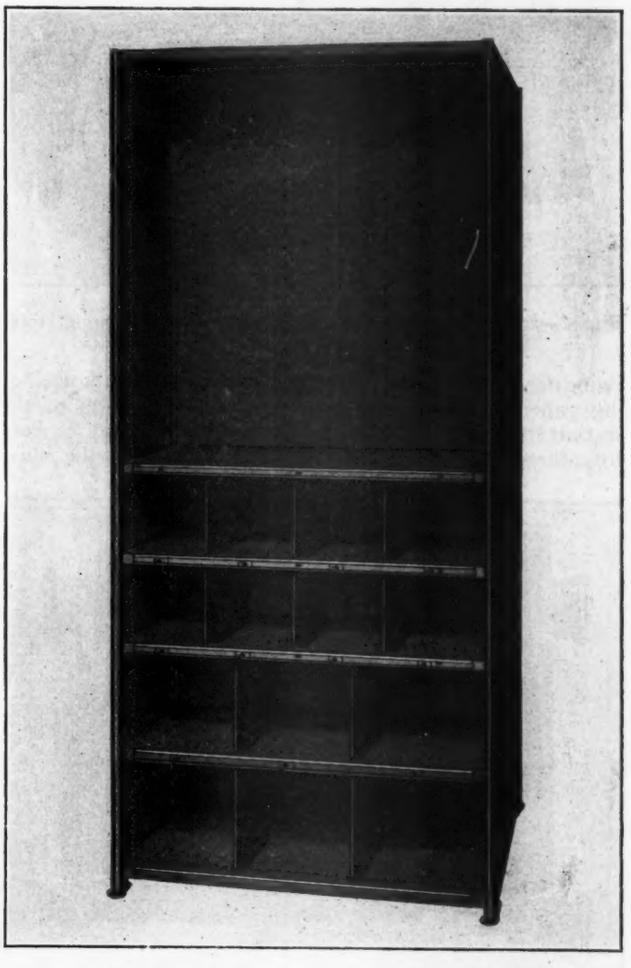


Fig. 1—Section of the Lyon steel tool room equipment

ters. These sections may be equipped with standard upright shelving, having either common or divided backs, or with sloping shelves for single or double-face racks. Provision is also made in the design of the shelving for the installation of check hooks.

Lyon steel toolroom equipment can be adapted for the storage of all types of tools usually kept in a toolroom. Figs. 2 and 3 show two types of inserts which can be placed in the top part of the section shown in Fig. 1. Fig. 2 is designed to provide space for small, as well as

large tools. The shelving dividers are placed on 2-15/16-in. centers, providing a total of 108 compartments. Fig. 3 shows an insert for holding milling cutters which are hung on pegs on 1-in. centers. The milling cutter insert consists of one stationary panel, 38 in. by 36 in., and two

Fig. 2—Insert equipped with sloping shelves for small tools

swinging panels, 38 in. by 18 in. Both sides of the swinging panels may be used if desired. The portion of the section shown in Fig. 1, underneath the insert may be used for other types of shelving than that shown in the illustration. This type of steel toolroom equipment requires a space 36⅞ in. wide by 18 in. deep, for each section of rack. It can be adapted to any toolroom layout and for handling all kinds of tools and shop fixtures.

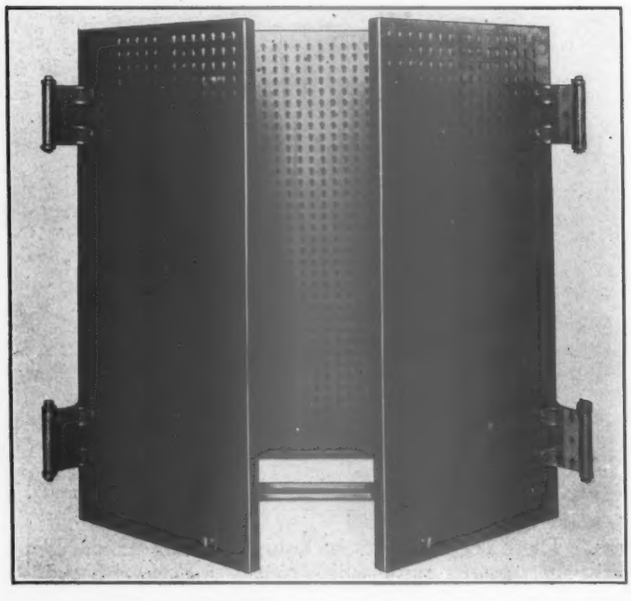
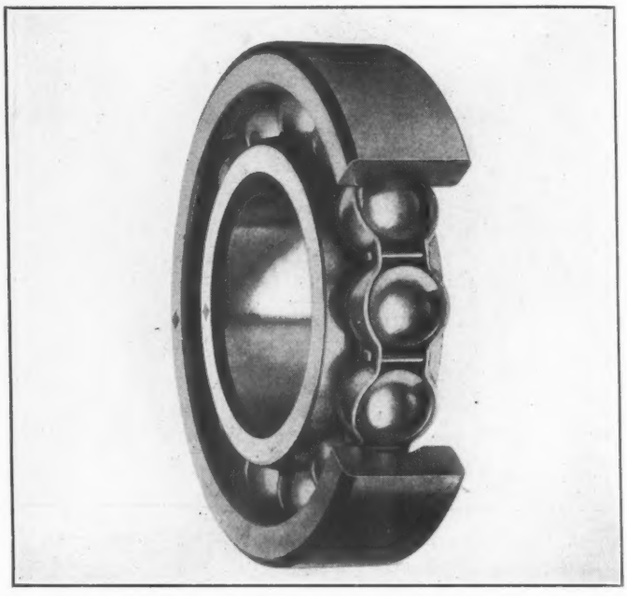


Fig. 3—Milling cutter insert—Fits in the top compartment of the section shown in Fig. 1

Balls in "SRB" bearings forged from molybdenum steel

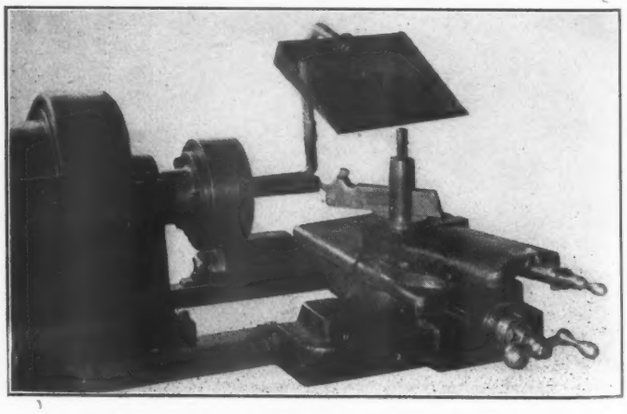
THE "SRB" annular ball bearing, single and double row, made by Standard Steel & Bearings, Inc., Plainville, Conn., is now equipped with balls forged from molybdenum steel, which has been selected to secure greater toughness, hardness, loading carrying capacity and durability.



SRB single row bearing provided with molybdenum steel balls

Acme eye shield for machine tools

THE Chicago Eye Shield Company, 2300 Warren avenue, Chicago, have placed on the market the Acme eye shield for use on such machines as grinders, buffers, saws, spot welders, lathes, planers, etc.



The Acme eye shield in position on a lathe

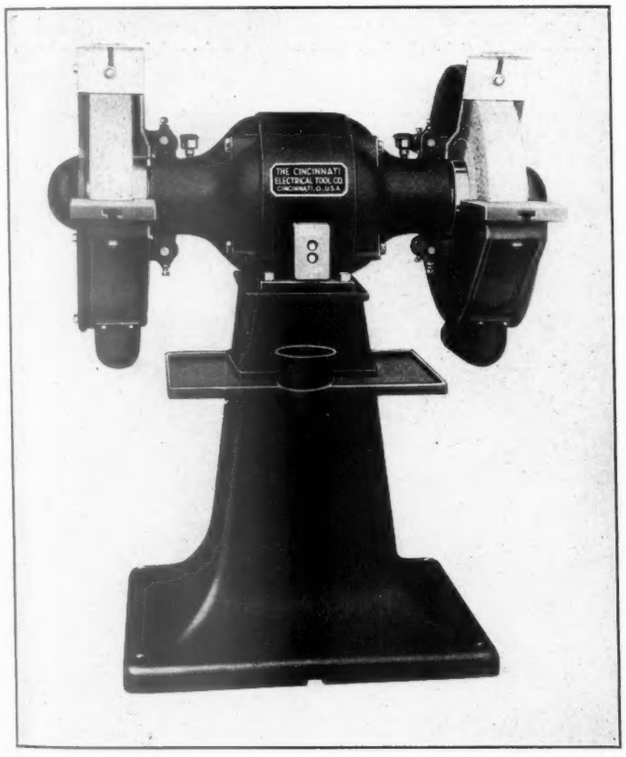
The glass is of the non-shatterable type which is not easily broken and will not scatter when broken by an unusually hard blow. The 7-in. by 4-in. glass protects the head and face of the workman.

The shield is furnished complete with adjustable steel brackets, pipe, lock nuts, wall brackets, an 18-in. flexible arm steel frame and glass. The flexible arm permits instant adjustment by hand without tools, to any desired position.

One shield can be used to cover both wheels of a double grinder, but where both wheels are in constant use, it is advisable to equip the machine with one shield for each wheel.

Heavy duty double end floor grinder

THE Cincinnati Electrical Tool Company, Cincinnati, Ohio, has recently added two new floor grinders to its line of portable electric tools. These new machines are respectively 2-hp. and 3-hp. fully enclosed heavy duty floor grinders. The steel spindles are turned and ground, and mounted in ball bearings which are enclosed in dust-proof housings. The bearings are locked to the spindles so as to provide end thrust and to minimize shaft wear. The wheel flanges and nuts are finished all over to provide



The motor and ball bearings of this grinder are enclosed in a dust-proof housing

proper spindle balance. The wheel guards are adjustable to the wear of the grinding wheels and are equipped with exhaust outlets. Removable covers bolted to the guard completely enclose the sides of the grinding wheels and the ends of the spindle.

The 2-hp. grinder is equipped to carry 12-in. by 2 in. by 1¼-in. grinding wheels and the 3-hp. grinder will carry 14-in. by 2½-in. by 1¼-in. grinding wheels. The electrical equipment is adaptable to either alternating current of 220 volts or 440 volts, 25 to 60 cycles, two or three phase; or direct current of 115 or 230 volts.

Lacerda countersinking frame

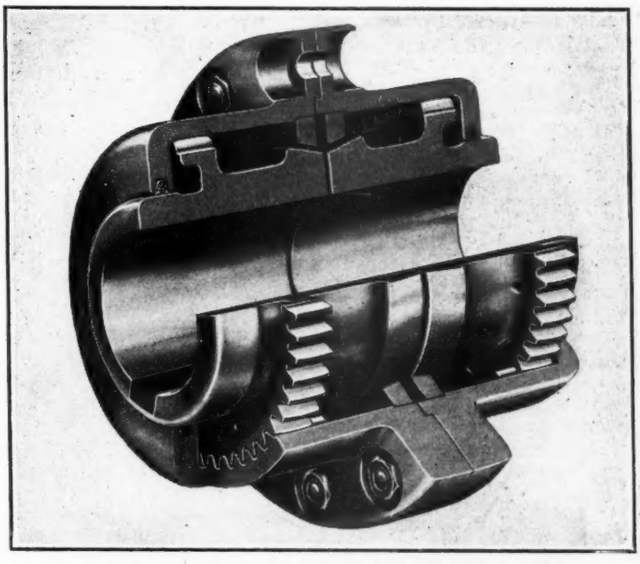
A COUNTERSINKING frame manufactured by the Lovejoy Tool Works, 319 West Ohio street, Chicago, is designed for countersinking rivet holes on the inside flanges of boiler sheets. Any flat air-motor is fitted with this yoke which extends over and outside of the flange. A feed screw with a swivel head passes through

Countersinking frame for use with flat air motors

this yoke and is directed against the outside of the flange directly opposite the drill point. Pressure applied to the screw feeds the countersink to the required depth. It is said that one man can countersink one hole per minute.

The Poole flexible coupling

THE Poole flexible coupling, manufactured by the Poole Engineering & Machine Company, Baltimore, Md., consists of six parts: two hubs having an external gear on each, meshing with internal gears in



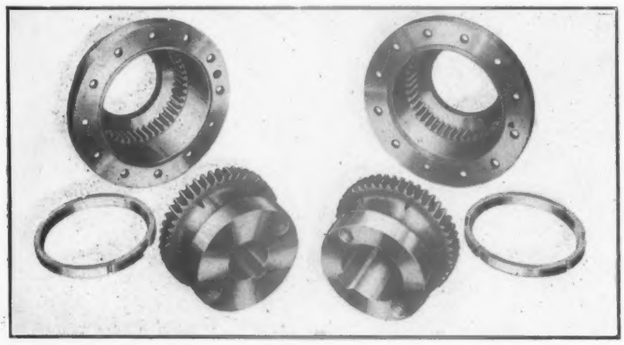
A sectional view of the Poole flexible coupling

two sleeves which are bolted together, and two alining rings which are fitted in the two sleeves.

The outer faces of the teeth on the hubs are formed spherically which provides a true self alining bearing for the connecting sleeve, so that if the two shafts are out of alinement, the sleeve assumes a neutral position with a

perfectly formed and lubricated bearing on the spherical surface of each shaft hub.

The coupling is easy to line up when the coupling and the connecting shafts are being assembled. Each hub of the coupling has a tapered surface which in turn engages with a tapered surface on the interior of each sleeve. When the sleeve is pushed back the sleeve, the hub and shaft act as a single unit and proper alinement can be quickly and accurately made by using a straight edge across the two flanges of the sleeve and calipers or feeler



The six parts which make up the flexible coupling

gages between the coupling faces. The sleeves and hub are never out of tooth engagement during alinement.

Oil holes are provided in one side of the coupling flange where oil should be poured in until it runs around the shaft hub. When the coupling is running, the oil spreads out under centrifugal pressure so that the sleeve bearings and gear teeth are entirely submerged in oil, which effectually prevents wear on any contact surfaces, and assures positive lubrication.

An automatic post valve

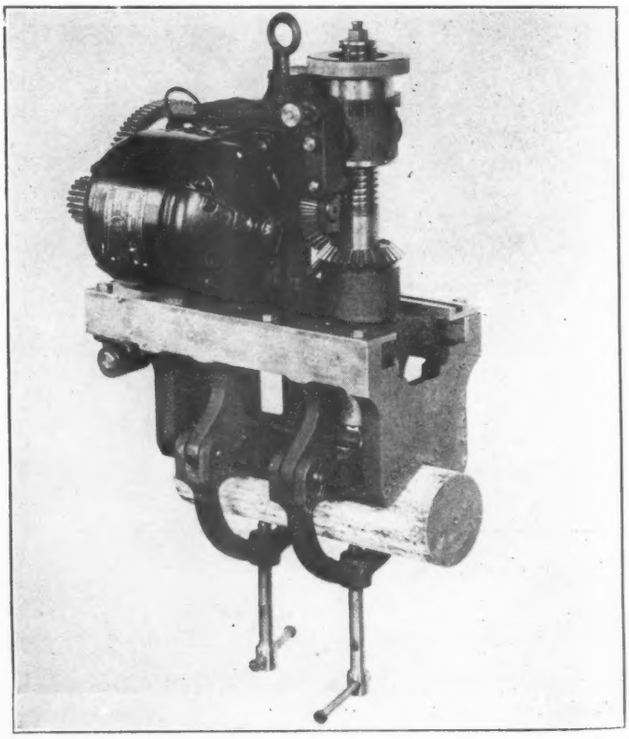
THE Gustin-Bacon Manufacturing Company, 14-16-18 West Twelfth street, Kansas City, Mo., has placed on the market an automatic post valve, known as the type G-B, for use in connection with the Lowrey hose coupling. A description of the Lowrey hose coupling was published in the March, 1924, issue of the *Railway Mechanical Engineer,* page 190.

The G-B automatic post valve

The G-B automatic post valve is so constructed that it automatically opens when the Lowrey coupling is connected to it and automatically closes when the coupling is disconnected. The construction of the valve is shown in the section view of the illustration. The area of the ports is 25 per cent greater than the orifices in the valve, which is considered sufficient to overcome any retarding action due to friction. The vent shown in the outlet end of the valve bleeds off the air in the hose line as the coupling is disconnected. This prevents the hose from whipping and also relieves the strain on the threads of the coupling. Screwing the male portion of the coupling into the automatic post valve pushes the valve off the seat and the valve does not reseat until the coupling is removed. The automatic post valve has no revolving plug to become scored, due to rust and other foreign matter.

Portable shaft keyseat miller

SHOWN in the illustration is a portable shaft keyseater manufactured by John T. Burr & Son, 421 Kent avenue, Brooklyn, N. Y. This keyseater is designed for operation by either electric or air motor. The electric motor-driven machine shown, has an automatic down-feed with traverse feed by hand through a rack and pinion. Keyseaters of this design can also be furnished in which both the traverse and down feeds are automatic. The



A portable shaft keyseater which can be used on shafts or pins up to 11 in. diameter

keyseater is self centering, the work of chucking consisting of placing the machine over the shaft or axle and clamping in position. It is a vertical spindle machine.

These keyseaters are made in various sizes for milling keyways and shafts up to 11 in. in diameter and having traverse feeds up to 12 in. The spindle is provided with a No. 7 B. & S. taper hole and can take standard course tooth end mills, up to 1¼ in. It runs in bronze bushings and the driving miter gears are of steel.

News of the Month

PROMOTIONS AND APPOINTMENTS · THE SUPPLY TRADE · CLUB AND ASSOCIATION NEWS · NEW TRADE PUBLICATIONS · NEW SHOPS

Fourth car building contest held by D. & H.

On Tuesday, May 18, the car department of the Delaware & Hudson held its fourth car building contest at Green Island, New York. The problem on this occasion was the rebuilding of the trucks, underframes and superstructure of a D. & H. 85,000-lb. capacity drop-bottom gondola. The three teams competing represented the car shops of the Pennsylvania, Susquehanna and Saratoga divisions where work of this character is the usual performance. The Saratoga team, which was declared the winner by the judges, completed the work in 6 hr. 11 min. and was awarded the Birkett memorial cup. The Green Island car shop is situated between Troy, N. Y., and Albany.

Railroad men visit A.R.A. air brake laboratory at Purdue

About 150 men, representing as many Class I railroads, gathered at Purdue University on Wednesday, May 12, to inspect for the first time the air brake testing laboratory and work now being performed at Purdue University in co-operation with the American Railway Association. For the benefit of the visitors a series of five demonstrations was staged, under three different conditions, making fifteen tests in all. H. A. Johnson, director of research at Purdue, explained that no results were available at that time and that none would be summarized for many months, nor would detail information as to how any particular set of equipment functioned be available until the whole work is completed.

Dean A. A. Potter and Prof. G. A. Young, head of the school of mechanical engineering, addressed the guests at luncheon. Dean Potter outlined briefly a history of Purdue and sketched the engineering experiment station work being performed at the institution.

New equipment

During the first three months this year Class 1 railroads installed in service 21,363 freight cars, according to reports with the Car Service Division of the American Railway Association. This was a decrease of 22,790 cars, as compared with the corresponding period last year of 16,289 cars compared with 1924. The total included 9,582 box cars, 9,069 coal cars and 1,206 refrigerator cars.

In March the railroads placed in service 8,546 freight cars, including 3,934 box cars, 3,477 coal cars and 544 retrigerator cars.

Class I railroads on April 1 had 49,524 freight cars on order, an increase of 3,398 compared with last year but a decrease of 19,774 compared with 1924. Of the total 20,846 were box cars, 20,237 coal cars and 6,099 refrigerator cars.

Also 570 locomotives were placed in service during the first quarter 1926 an increase of 140 compared with the first quarter in 1925 but a decrease of 91 locomotives compared with 1924. Class I railroads on April 1 had 738 locomotives on order, compared with 315 on the same date last year and 520 on the same date two years ago.

These include new and leased equipment.

Bureau of Explosives

Colonel B. W. Dunn, chief inspector of the railroads' bureau for the safe transportation of explosives and other dangerous articles, has issued his 18th annual report, which is for the year ending December 31, last. Under the head of explosives proper, the record for the year shows 26 accidents but no persons killed or injured; property loss, $11,702.

Including explosives "and other dangerous articles" the total for 1925 is 1,601 accidents in railway transportation, 13 persons killed, 57 injured; total property loss $1,056,178. Of this total 78 per cent is charged to inflammable liquids, mainly gasoline. Under the head of inflammable liquids the causes are given as: negligence of employees, 23 cases; rough handling, 103 cases; improper loading, etc., 184 cases; derailment or collision, 66 cases; miscellaneous, 322 cases. Ten persons lost their lives and 15 were injured as a result of explosions of gasoline. One-half the deaths and more than one-half of the injuries due to such accidents were the direct consequences of trespassers entering empty tank cars. The 66 train accidents are charged with an aggregate loss, under this head, of $650,847. The aggregate quantity of explosives transported on the railroads of the country during the year (with no death or personal injury) was over 500 million pounds. This record, says Colonel Dunn, affords positive evidence of excellent team work by thousands of factory and railroad employees. The report contains the usual chapters on the results of the studies, experiments and inspections made by the employees of the bureau during the year. M. L. Oglesby, special representative of the bureau, has during the year delivered 193 addresses before meetings which had a total attendance of 16,259. Other lectures have been delivered at 433 places to meetings recording an aggregate attendance of 19,762.

Reprints of bulletins which have been issued by the bureau during the year fill an appendix of 30 pages.

A. R. A. purchases draft gear drop-test machine

The American Railway Association has authorized an appropriation for the purpose of building, installing and housing a drop-test machine for testing draft gears to determine their capacity, absorption of recoil and endurance, and from the information obtained prepare suitable specifications under which the railroads may purchase draft gears that are known to meet the prescribed standards of efficiency. It will also be used to obtain information that will be of assistance in developing draft gears generally. The contract for the machine has been awarded to the Tinius-Olsen Testing Machine Company, Philadelphia, Pa., delivery being called for by November 1, 1926, and arrangements have been made to have it installed in the test department of Purdue University, Lafayette, Ind. The installation of this machine, together with auxiliary apparatus and equipment, will necessitate the construction of a new brick and steel building, 50 ft. by 125 ft. on the Purdue campus. All expenses for the work, which will be about $50,000 this year, will be borne by the American Railway Association. Annual expenditures will range from $10,000 to $15,000 until the tests are completed. The tests are to be conducted by the engineering experiment station of Purdue University and will be under the direct supervision of Dean A. A. Potter, the director.

The drop-test machine will be provided with two falling weights or tups. The larger one will weigh 27,000 lb. and is believed to be heavier than any heretofore used for the purpose, while the smaller one will weigh 9,000 lb., the weight most frequently used in the past. The weights may be readily removed or applied without dismantling the vertical columns.

The machine will be driven electrically, the control equipment being so designed that operation may be manually or automatically controlled, and it will be provided with a chronograph for recording the action of the draft gear or gears being tested throughout the cycle of compression and release.

Meetings and Conventions

Program Mechanical Division convention at Atlantic City

The seventh annual meeting of Division V—Mechanical, American Railway Association, will be held in the Greek Temple on Young's Million Dollar Pier, Atlantic City, N. J., June 9 to 16, inclusive. Following the custom of years, the sessions will be held each day from 9:30 a. m. to 12:30 p. m. (daylight saving time). The first week's program, Wednesday, Thursday and Friday, June 9 to 11, inclusive, is devoted to car subjects, while the second week's program, Monday, Tuesday and Wednesday, June 14 to 16, inclusive, is devoted particularly to motive power subjects. The program is as follows:

WEDNESDAY, JUNE 9

Address by R. H. Aishton, president, American Railway Association
Address to be announced
Address by chairman
Action on minutes of annual meeting of 1925
Appointment of Committees on Subjects, Resolutions, Correspondence, etc.
Unfinished business
New business
Committee reports:
- General
- Nominations
- Design of Shops and Terminals

THURSDAY, JUNE 10

Committee reports:
- Arbitration
- Prices for Labor and Materials
- Safety Appliances
- Specifications and Tests for Materials
- Loading Rules

FRIDAY, JUNE 11

Committee reports:
- Car Construction
- Tank Cars
- Brakes and Brake Equipment
- Couplers and Draft Gears

MONDAY, JUNE 14

Report of Committee on Locomotive Design and Construction
Election of Officers
Report of Committee on Wheels

TUESDAY, JUNE 15

Committee reports:
- Electric Rolling Stock
- Locomotive and Car Lighting

WEDNESDAY, JUNE 16

Report of Committee on Utilization of Locomotives
Individual paper—An Analysis of Relative Tracking Characteristics, by H. H. Houston, Westinghouse Electric & Manufacturing Company
Closing exercises

A.S.M.E. to hold spring meeting in San Francisco

Final arrangements have been completed for the spring meeting of the American Society of Mechanical Engineers to be held at San Francisco, June 28 to July 1, 1926. The program includes a number of subjects of interest to railroad men. On Tuesday morning, June 29, there will be papers presented on the Growth of University Extension Training of the Non-College Type for the Industries of the West, and on Education and Training of Apprentices on the Pacific Coast. A joint meeting of the Fuel and Railroad Divisions is scheduled for Wednesday morning, June 30, at which session papers on Combined Oil and Gas-Burning Furnaces for Power Plant Use; Fuel Oil for Railways, and the Development of the Caterpillar Tractor and Its Application to Industry, will be presented. Following is the program of the spring meeting:

MONDAY, JUNE 28

Morning—Council meeting.
Conference of local sections delegates.
Meeting nominating committee.
Afternoon—Excursion to Muir Woods and alternate excursions. Shopping trips for ladies.
Evening—Reception and dance.

TUESDAY, JUNE 29

Morning—Meeting nominating committee.
Simultaneous sessions.
Petroleum—
- Fluid Flow in Pipes of Annular Cross-section, by D. H. Atherton.
- Mechanical Engineering in Cracking, Heating and Cooling of Oil, by B. N. Broido.
- The Termination of Charcoal tests, by F. L. Kallam.

Industrial Training and Education—
- The Growth of University Extension Training of the Non-College Type for the Industries of the West, by John L. Kerchen.
- Education and Training of Apprentices on the Pacific Coast, by Paul Eliel.

Afternoon—Steamer trip on San Francisco Bay. Ladies' bridge party.

WEDNESDAY, JUNE 30

Morning—Meeting nominating committee.
Simultaneous sessions.
Fuels and Railroad—
- Combined Oil and Gas-Burning Furnaces for Power Plant Use, by J. Grady Rollow.
- Fuel Oil for Railways, by J. C. Martin, Jr.
- The Development of the Caterpillar Tractor and Its Application to Industry, by Pliny E. Holt.

Hydraulic—
- Aspects of Steam Power in Relation to a Hydro Supply, by A. H. Markwart.
- Water Power and Steam Power in California Utilities, by H. A. Barre.
- Speed Changes of Hydraulic Turbines for Sudden Changes of Load, by E. B. Strowger and S. Logan Kerr.

Oil and Gas Power—
- Transmission of Power on Oil-Engine Locomotives, by A. I. Lipetz.
- Oil Engines as a Drive for Pipe Line Pumps, by F. Thilenius.
- Uniform methods of Calculating the Periodic Displacement and Oscillations in Synchronous Machines, by C. W. Cutler.

Afternoon—Auto tour around San Francisco.
Excursions.
Ladies' tea at Fairmount Hotel.
Evening—Banquet.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Next meeting June 9-16, inclusive, Young's Million Dollar Pier, Atlantic City, N. J.
DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago. Next meeting September 21-23.
DIVISION VI.—PURCHASE AND STORES.—W. J. Farrell, 30 Vesey St., New York. Next meeting, June 9, 10 and 11, in the Vernon Room of the Haddon Hall Hotel in Atlantic City.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago. Annual convention September 1-3, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting June 21-25, Atlantic City.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting October 27-30, Chicago.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd St., E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club Building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings, second Thursday each month, except June, July and August. Hotel Statler, Buffalo, N. Y.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway. Clearing Station, Chicago. Convention September 21, 22 and 23, Hotel Sherman, Chicago.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings, second Tuesday, February, May, September and November.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month except July, August and September, at Hotel Hollenden, East Sixth and Superior Ave., Cleveland, Ohio. Next meeting June 7. Paper on What can the car department do to better transportation conditions in the United States, will be presented by D. F. Stephens, general superintendent, B. & O., Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next convention August 17-19, Hotel Winton, Cleveland, Ohio.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchinson, 1809 Capitol Ave., Omaha, Neb.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September. Copley-Plaza Hotel, Boston, Mass.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CLUB OF GREENVILLE.—F. D. Castor, clerk, maintenance of way department, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern Railway Shops, Atlanta, Ga.

TEXAS CAR FOREMEN'S ASSOCIATION.—A. I. Parish, 106 West Front St., Fort Worth, Tex. Regular meetings, first Tuesday in each month. Terminal Hotel Bldg., Fort Worth, Texas.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting September 14-17, Hotel Sherman, Chicago.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 226 W. Jackson Blvd., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

The American Car & Foundry Company has moved its office in New York from 165 Broadway to 30 Church street.

The Cleveland Pneumatic Tool Company has removed its Boston, Mass., office from 60 High street to 142 Berkeley street.

T. O'Malley, president of the O'Malley-Beare Valve Company, Chicago, died in that city on May 14, as the result of a case of acute indigestion.

W. C. Peters has been elected vice-president in charge of engineering and sales of the National Railway Appliance Company, New York. Mr. Peters was born on September 29, 1891, at St. John, New Brunswick, and was educated at the English High School, Worcester, Mass., taking the mechanical engineering course at the Worcester Polytechnic Institute. He entered the employ of the Boston & Albany in June, 1911, as special apprentice in the locomotive shops at West Springfield, and successively held positions of shop draftsman, foreman, safety appliance inspector, and then served from January, 1915, to April, 1920, in the office of the superintendent of motive power and rolling stock at Boston, Mass., as draftsman and assistant mechanical engineer. He enlisted with the 14th Engineers (Light Railway) in June, 1917, going overseas in July, 1917; the regiment first being assigned to the Third British Army North, where it operated on the Somme Front from August, 1917, until after the general British retreat in March, 1918. The regiment then joined the American troops in July in the Chateau-Thierry Sector, subsequently joining in all the future major engagements of the United States Forces. After spending two years overseas Mr. Peters returned as first lieutenant and was discharged in July, 1919. He became associated with the National Railway Appliance Company as manager of the New England department in April, 1920, and since April, 1924, was manager of sales and engineering until his election on April 1 as vice-president in charge of engineering and sales.

W. C. Peters

The Flexo Supply Company, St. Louis, Mo., has removed its office from 104 South Main street to 4459 Manchester avenue, St. Louis, Mo.

The Timken-Detroit Axle Company has removed its New York City office from 2 Rector street to 41 East Forty-second street, New York City.

The Hutchins Car Roofing Company has moved its Chicago office from 310 South Michigan Avenue, to 122 South Michigan Avenue.

F. A. Ogden, Jr., dealer in railway car specialties, has removed his office from 1011 B. F. Jones building to 528 Fourth avenue, Pittsburgh, Pa.

The Railway Materials Company, Chicago, has moved its offices from the Wrigley building to the Old Colony building, 407 South Dearborn street.

John Mulligan, president of the Ulster Iron Works, Dover, N. J., died on May 5 at Clifton Springs Sanatorium, Clifton Springs, N. Y., at the age of 56.

W. C. MacFarlane, vice-president and general manager of the Minneapolis Steel & Machinery Company, Minneapolis, Minn., has been elected president of that company.

John Hulst, assistant to vice-president and chief engineer of the United States Steel Corporation at New York, has been elected a vice-president to succeed John Reis, resigned.

L. R. LeMoine, chairman of the board of the United States Cast Iron Pipe & Foundry Company, Philadelphia, Pa., died on April 23 in Villa Nova, Pa., after a brief illness.

J. H. Larmonth, Montreal, has been elected vice-president and Gordon W. Dunn, Montreal, has been elected vice-president and managing director of the P. & M. Company, Limited.

H. M. Curry, Jr., has been elected president of the Premier Staybolt Company, Pittsburgh, Pa., J. F. McGann has been appointed assistant sales manager and C. B. Woodworth, technical representative.

J. V. Conway, special railroad representative of the Chicago Pneumatic Tool Company, has resigned to become western railroad representative of the Heywood-Wakefield Company, with headquarters at Chicago.

R. L. Cluverius has been appointed southern department manager of the National Railway Appliance Company, with headquarters in the Munsey building, Washington, D. C., succeeding H. W. Kidwell, resigned.

Thomas O'Brien, after a service of 16 years as engineer and sales manager with the John F. Allen Company, New York, has left that company and become associated with the Reliable Machine & Tool Company, New York City, in a capacity similar to his former connection.

The Sullivan Machinery Company has moved its Knoxville, Tenn., office, of which E. L. Thomas is manager, from 614 Market street to 623 Market street. Charles B. Officer, assistant to the president on engineering matters, has been promoted to chief engineer.

Herbert H. Moffitt, who has for some time represented the company as southeastern sales representative, with headquarters at the Woodward building, Washington, D. C., has been appointed vice-president in charge of sales for the southeastern district, with the same headquarters.

F. O. Salee, sales manager of the pump and tank division of the Wayne Tank & Pump Company at Fort Wayne, Ind., has been appointed sales manager of the Domestic Appliance Division, succeeding F. S. Fenton, Jr., resigned. Mr. Salee will be succeeded by A. D. Carriger.

A. E. Pratt has been placed in charge of the railway sales of Duco and other finishing materials of E. I. duPont de Nemours & Co., with headquarters at Parlin, N. J. Mr. Pratt was born at West Scarborough, Me., on December 11, 1887, and was educated at Mount Union College and Western Reserve University. After leaving college he spent two years in the maintenance of way department and signal construction on the western lines of the Erie. In October, 1909, he was appointed supervisor of signals of the Buffalo Creek at Buffalo, N. Y. In January, 1913, he returned to the Erie and he served as general signal foreman of construction while automatic signals were being installed on four divisions. In November, 1916, he was appointed signal supervisor of the Buffalo division of the Erie and in April, 1917, was transferred to the Kent division, with headquarters at Marion, Ohio. On March 1, 1918, he resigned to go as sales engineer in the railroad department of the National Carbon Company. Early in 1922 Mr. Pratt was promoted to assistant manager and in January, 1923, was ap-

A. E. Pratt

pointed manager of railway sales of the National Carbon Company, Inc., and the Prest-O-Lite Company, Inc., which position he held at the time of his recent appointment.

T. J. Powell, formerly district manager for the Galena Signal Oil Company, St. Louis, has been appointed vice-president in charge of sales for the Union Railway Equipment Company, in southwestern territory, with headquarters at room 2089 Railway Exchange building, St. Louis, Mo.

George W. Morrow, supervisor of track of the New York, New Haven & Hartford, on June 1 will leave that position to join the sales staff of the Ingersoll-Rand Company, reporting to the Chicago office. He supplants E. F. Kultchar, who was recently transferred to the locomotive department.

The Crankless Engine Company of America, 29 Broadway, New York, announces through Dr. E. H. Armstrong of New York that contracts have been signed with a syndicate to manufacture crankless Diesel engines for railway, marine and industrial uses in large quantities. Production will start within 30 days.

Burt Fleeger, treasurer, sales manager and a director of Sivyer Steel Casting Company, Milwaukee, Wis., has resigned to become vice-president of the Oklahoma Steel Castings Company, Tulsa, Okla. This company is preparing plans for an extensive addition and is purchasing more equipment to increase its capacity of electric steel castings.

Charles E. Koch, who has served for some time in the Reading Iron Company's mills at Reading, Pa., will, in future, call on pipe buyers in the Reading territory of the Reading Iron Company, confining his efforts to Eastern Pennsylvania in the interests of Reading pipe. His headquarters will be at the general office of the company, Reading.

Walter C. Doering, representative of the Bradford Corporation, with headquarters at St. Louis, Mo., has been elected vice-president, with headquarters at Chicago. William D. Otter has been appointed manager of the Western district, with headquarters at San Francisco, Cal., to succeed W. W. Rosser, who has resigned to enter business for himself. Mr. Doering was born on September 12, 1886, in Bellville, Ill., and entered business with the St. Louis Car Wheel Company on January 1, 1900. This company was absorbed by the Southern Wheel Company in 1912, and until 1920 he held various positions with this company including assistant to the vice-president, and assistant to the president. In 1920 he was elected a vice-president. On January 1, 1923, Mr. Doering resigned from the Southern Wheel Company to engage in the railway supply business in St. Louis on his own account, representing the Bradford Corporation, the American Brake Shoe & Foundry Company, and the Pittsburgh Steel Products Company, which position he has held until his recent election.

W. C. Doering

The Hall Laboratories, Inc., has been organized, with Ralph E. Hall, formerly physical chemist, U. S. Bureau of Mines, as director. The Laboratories will act as consultatnts on the application of recent discoveries to the elimination of scale and corrosion in steam plants. The headquarters of the Laboratories are at 304 Ross street, Pittsburgh, Pa.

The Ludlum Steel Company, Watervliet, N. Y., is building a continuous furnace of modern construction and design, and is also enlarging and entirely rebuilding one of the ingot heating furnaces for its 18-in. mill. The Ludlum heat and scale resisting material is being used in the recuperative equipment of the billet heating furnace, also Delhi Tough in tube form.

Leslie S. Hall, whose appointment as president and general manager of the new company, Hall-Will, Inc., at Erie, Pa., was announced in the May issue of the *Railway Mechanical Engineer*, started in the machine tool field in Canada twenty-four years ago, with his father, under the name of John H. Hall & Sons. He designed all of the standard and special machines manufactured by that company, and also designed and built special machines for the tube mills of Canada and the British Munitions board. In 1920, Mr. Hall, as president, sold the company of John Hall & Sons to the Williams Tool Corporation, and was elected vice-president of both the Canadian and American companies, also general manager of the Canadian plant. Three months later he went to Erie and assumed the general management of both the Erie and Canadian plants. While in charge of the Erie plant, he designed the "Willie Williams" and "Williams Rapiduction" machines. On March 31 of this year he resigned as vice-president and general manager of the plant at Erie. He is still president and general manager of the Williams Tool Corporation of Canada, which is separate from the company at Erie.

L. S. Hall

G. C. Hay, formerly sales manager of the Williams Tool Company and now sales manager of Hall-Will, Inc., has had a wide experience in the machine tool field.

G. C. Hay

J. W. McLeod, works manager of the new company, has had ten years' experience in every phase of the pipe machine industry. For the past four years he was associated with the Williams Tool Corporation and, previous to that time, was in the same line of manufacture with John H. Hall & Sons, Canada.

Fred C. Rumball, branch manager of the Timken Roller Bearing Service & Sales Company, with headquarters at Kansas City, Mo., has been promoted to sales engineer, automotive division of the Timken Roller Bearing Company, with headquarters at Cleveland, Ohio, and will be succeeded by J. M. Carey, salesman. T. F. Rose, assistant branch manager of the Timken Roller Bearing Service & Sales Company, with headquarters at Chicago, has been promoted to branch manager with headquarters at Cincinnati, Ohio. H. C. Sauer, assistant branch manager, with headquarters

J. W. McLeod

at Cleveland, has been promoted to branch manager, with headquarters at Detroit. The branch office at Baltimore, Md., has been closed and service will be supplied through the Richmond, Pittsburgh and Philadelphia branches.

James T. Waite, formerly New England sales engineer of the Whitman & Barnes Manufacturing Company, has been appointed general sales manager of the New Process Twist Drill Company, Taunton, Mass. George R. Hine, formerly general superintendent of the Whitman & Barnes Manufacturing Company, has been appointed works manager of the New Process Twist Drill Company, in control of the company's entire line of twist drills and other products.

Alexander S. Henry was, on May 14, elected president of the Railway Steel-Spring Company, Inc., which is now a subsidiary of the American Locomotive Company. Mr. Henry's early experience in the iron and steel business was obtained among the steel mills of the Cleveland district and vicinity, where he served in various capacities, principally in the open-hearth departments. He later entered the employ of one of the steel-tired wheel plants in Cleveland which subsequently became a part of the Steel-Tired Wheel Company, and during its existence he was in charge of the local management of a number of its plants. When the company was merged with the Railway Steel-Spring Company in 1902, he was called to New York and appointed assistant secretary, acting in a supervisory capacity in the selling and operating departments of the steel-tired wheel and the steel tire divisions of the Company. In 1910 he was elected a vice-president and assumed charge of the operations of the various plants of the company, including the tire-plants at Latrobe, Pa., and Chicago Heights, Ill. In 1920, he was elected a director of the company and a member of the executive committee.

A. S. Henry

On June 1st the draft gear activities of the Westinghouse Air Brake Company were assumed by the Westinghouse Friction Draft Gear Company, with sales headquarters at Room 913, Peoples Gas Building, Chicago. This change has been made to more effectively serve the demand for the type N draft gear. H. B. Gardner, formerly a representative of the Westinghouse Air Brake Company in the New York district, has been appointed general sales Manager of the Draft Gear Company, with headquarters at Chicago.

A. S. Osbourne, president of the Universal Packing Corporation, Pittsburgh, Pa., has resigned to go as mechanical officer with the Pittsburgh Terminal Coal Company. Alexander M. Donnan, secretary and treasurer, has resigned, and has been appointed on the legal staff of the Pennsylvania Railroad. J. J. McQuillen, vice-president of the Universal Packing Corporation, has been elected president; J. M. Bandish, southern district sales manager, has been elected vice-president, and Herbert Lewis has been appointed manager of railroad sales with headquarters at Pittsburgh, Pa.

J. Barraja-Frauenfelder & Co., New York, has been established, a consulting and advisory service on oil and Diesel engines, their application to the industries and the manufacturing or applying of this equipment. The organization is composed of J. Barraja-Frauenfelder, executive engineer; Heinrich Schneider, associate engineer; Edward C. Magdenburger, associate engineer, and others who have had many years of theoretical and practical experience in this and allied branches of engineering. Mr. Schneider is an authority on Diesel engine design, testing and manufacturing, especially as applied to railroad installation; also an authority on hydraulic transmission. The establishment of a testing laboratory fully equipped for material and other testing also is planned so that complete research work can be carried out by the staff of the organization.

Edwin S. Mills, general manager of sales of the Illinois Steel Company, Chicago, has been elected a vice-president. Besides being general manager of sales of the Illinois Steel Company, he is manager of sales of the Tennessee Coal, Iron & Railroad Company, and of the Carnegie Steel Company, all subsidiaries of the United States Steel Corporation. He was born at New Brighton, Pa., on June 5, 1870, and entered business as manager of sales of the Carnegie Steel Company, Cleveland, Ohio, in 1895. From 1910 to 1919 he was subsequently general manager of the Pittsburgh Steamship Company, agent of the Oliver Iron Mining Company, assistant to the vice-president of the United States Steel Corporation at New York, and special sales agent of the Carnegie Steel Company. In 1919 he was promoted to general manager of sales of the Illinois Steel Company, which position he has held until his recent election.

Victor Angerer, well known in both the street and steam railroad field died of pneumonia at his home in Ridley Park, Pa., on May 5, at the age of 64. He was a native of Austria, and graduated at the age of 17 from the Technical College in Vienna. Shortly afterwards he came to the United States, and for about four years he was with William Sellers & Co., Philadelphia, in the capacity of draftsman. In 1884, he associated himself with William Wharton, Jr., & Co., Ltd., as a mechanical engineer. After serving in various engineering and supervisory capacities he became vice-president and general manager in 1902. For some years he taught in the Franklin Institute, Philadelphia. Upon the consolidation of William Wharton, Jr., & Co., and the Taylor Iron & Steel Company, in 1912, when the Taylor-Wharton Iron & Steel Company was formed, he was made vice-president of the latter company and of its subsidiaries, William Wharton, Jr., & Co., Inc., Easton, Pa., the Philadelphia Roll & Machine Company and the Tioga Steel & Iron Company, Philadelphia. In 1922, he was made a director, holding this position until his death. He introduced the use of manganese steel in electric railway track work in 1894 and in steam railroad track work in 1899. He was also author of various general designs of manganese steel track structures now in general use.

Frederick F. Fitzpatrick, president of the Railway Steel-Spring Company, was on May 14 elected president of the American Locomotive Company. This election was in accordance with the plans of the amalgamation of the Spring Company and the American Locomotive Company originally announced last March. W. H. Woodin, hitherto president of the American Locomotive Company, has been elected chairman of the board of that company. Mr. Woodin is also president of the American Car and Foundry Company. Alexander S. Henry, formerly vice-president of the Railway Steel-Spring Company, was elected president and Mr. Fitzpatrick chairman of the board of the Spring Company. Mr. Fitzpatrick, has been president of the Railway Steel-Spring Company since 1910. In 1898 he was appointed St. Louis representative of the Charles Scott Spring Company which was merged with the Railway Steel-Spring Company upon its organization in 1902. In 1905, three years after the formation of the Railway Steel-Spring Company, he was made general sales agent, with headquarters in New York. He was elected a vice-president, in charge of sales in 1907, and president of the company in 1910.

F. F. Fitzpatrick

The Railway Steel-Spring Company will continue to operate as it has always done; no changes whatever are contemplated in the management or personnel.

Trade Publications

RIVETING HAMMERS.—An eight-page, illustrated folder descriptive of the new Thor riveter construction has been issued by the Independent Pneumatic Tool Company 600 W. Jackson boulevard, Chicago.

CRANES.—Electric and hand-power traveling cranes, cranes for freight handling, and the Whiting portable car hoist are illustrated in three, four-page folders which have been issued by the Whiting Corporation, Harvey, Ill.

POWER PLANT EQUIPMENT.—Ernest E. Lee Company, 115 S. Dearborn street, Chicago, is issuing Catalogue No. 26 descriptive of power plant equipment manufactured by the various concerns it represents in Illinois, Wisconsin, Indiana and Iowa.

MEEHANITE METAL.—A four-page, illustrated folder descriptive of Meehanite metal has been issued by the Whiting Corporation, Harvey, Ill. This metal is a pearlite iron having unusual physical properties, with a tensile strength varying from 45,000 to 70,000 lb. per sq. in., as against 20,000 to 30,000 lb. for ordinary grey iron.

VENTILATOR WINDOWS.—The Bogert & Carlough Company, Straight street, Paterson, N. J., has just published a 16-page catalogue, No. G-26, entitled "Boca Top and Bottom Sliding Ventilator Windows with Bronze Guides." It describes in detail the architectural and industrial types of projected windows and illustrates in color the Boca bronze guide feature.

STEAM TURBINE INSTRUMENT.—The Uehling Instrument Company, 473 Getty avenue, Paterson, N. J., is distributing catalogue No. 150, descriptive of its combined barometer and vacuum recorder for use with steam turbines. Valuable turbine performance data, typical charts, sectional views and dimension diagrams, including reference to a new model instrument for flush mounting on panel boards, also are included in the catalogue.

STEAM ECONOMY.—Catalogue S-22, descriptive of Republic installations in many industries and the theory and construction of steam flow meters, has been issued by the Republic Flow Meters Company, 2240 Diversey Parkway, Chicago. The information contained in the catalogue is a compilation of the experience of the company's engineering force, covering a period of five or ten years on the subject of methods for reducing steam costs.

WROUGHT PIPE.—A new educational motion picture film, entitled "The Arteries of Industry," is described in a 16-page folder which has been issued by the National Tube Company, Frick building, Pittsburgh, Pa. This film illustrates the process of manufacture of National pipe, step by step, from the mining of the ore to the final tests and inspections. Many of the more important steps also are illustrated graphically by animated diagrams.

FORGED TOOLS.—Amplified wrench index tables, giving dimensions of wrench openings to fit standard nut and bolt sizes, and a number of new tools appear in the 120-page catalogue of mechanics' tools being issued by the Billings & Spencer Company, 721 Main street, Hartford, Conn. Open end machine wrenches; spanner wrenches; machine and socket wrench sets; wrench boards; socket and adjustable wrenches; pliers; screwdrivers; chisels; hammers; chain pipe wrenches, both single and double jaw; dogs, C-clamps; ratchet drills, and miscellaneous standard forgings are listed in this catalogue.

CHUCK WORK.—This is the second section of the publications on chuck work and the third and final one of a series of booklets issued by the Warner & Swasey Company, Cleveland, Ohio, dealing with modern methods of tooling turret lathes. Three chapters of this booklet are of particular interest—the discussion of piloting, the treatment of permanent set-up and a chapter devoted to a consideration of the economic advantages of specially designed tooling equipment for turret lathe work. In this, together with the two foregoing books, the shop man will find the answers to many questions concerning equipment and methods which will be of valuable assistance in planning both small lot and quantity production jobs on turret lathes.

Personal Mention

General

FRANK S. ROBBINS, formerly Philadelphia representative of the Pittsburgh Testing Laboratories, has been appointed superintendent of motive power and machinery of the Florida East Coast, with headquarters at St. Augustine, Fla.

Master Mechanics and Road Foremen

F. W. FOLTZ has been appointed road foreman of engines of the Eastern division of the Missouri Pacific succeeding F. W. Gratiot.

ALBERT C. DUNN has been appointed road foreman of engines of the Delaware division of the Pennsylvania, succeeding S. V. Sproul, deceased.

H. C. GUGLER, master mechanic of the Chicago, Burlington & Quincy, at Wymore, Neb., has been transferred to Sheridan, Wyo., succeeding Mr. Johnson.

G. E. JOHNSON, master mechanic of the Chicago, Burlington & Quincy, at Sheridan, Wyo., has been transferred to Wymore, Neb., succeeding H. C. Gugler.

EDWARD F. SMITH has been appointed road foreman of engines of the Yellowstone division of the Northern Pacific, with headquarters at Forsyth, Mont.

JAMES A. REDDEN, engineman on the Delaware division of the Pennsylvania, has been promoted to assistant road foreman of engines of the Baltimore division.

Shop and Enginehouse

J. R. VOGELSINGER, boiler foreman of the Erie at Dunmore, Pa., has been transferred to Hornell, N. Y., as general boiler foreman.

Car Department

W. H. FOWLER has been appointed general car foreman of the Southern Pacific, lines in Texas and Louisiana, with headquarters at Houston, Tex., succeeding J. D. Freeman, who has retired.

GEORGE SEELEY, assistant chief draftsman at the Keyser Valley shops of the D. L. & W., at Scranton, Pa., has been appointed assistant master car builder, with headquarters at Hoboken, N. J., succeeding J. P. Brogan, deceased.

Obituary

HARLEY E. DUTTON, purchasing agent of the Green Bay & Western, died recently, after many months' illness.

EDWARD POSSON, who was retired as engineer of car construction of the Atchison, Topeka & Santa Fe on July 1, 1924, died on March 7.

W. F. RENSHAW, formerly general superintendent of motive power of the Illinois Central, who retired in 1908, died at Chicago on May 8 at the age of 75 years.

J. P. BROGAN, assistant master car builder of the Delaware, Lackawanna & Western, with headquarters at Hoboken, N. J., died suddenly in Florida on May 3. Mr. Brogan was born in Scranton, Pa., on February 10, 1877. He secured his early education in that city, and in 1906 entered the car shop of the D., L. & W. at Scranton, under Mr. McKenna, who was then master car builder. He subsequently worked in the mill, light repair, heavy repair, erecting, machine and pipe shops, and assisted in putting the first air brakes on D., L. & W. cars. During this time Mr. Brogan had been attending the Scranton Business College at night. He graduated as a bookkeeper and stenographer, and in 1898 was appointed to the position of stenographer at the Dover, N. J., cars shops, and in 1899 became chief clerk in the car department at the Hoboken terminal. In 1908 he was appointed general foreman of the car department at Hoboken, and in 1918 became assistant master car builder of the entire system.